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THE VALUE AND LIMITS OF THE EXPERIMENTAL METHOD IN PSYCHOLOGY

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I

It is useless to expect that any agreement will be reached on the practical and theoretical value of experiments in psychology until a fundamental misunderstanding has been finally removed, a misunderstanding which does not appear to have been fully overcome so far. It consists in a continually recurrent tendency to speak of a separate *experimental* psychology which is supposed to differ from every other kind of psychology with regard not only to its methods but also to its object, its final results (viz., additional knowledge of the facts about mankind), and its scientific ranking.

A simple historical consideration should suffice to preserve us from such a naïve estimate of a method or a system of research as contrasted with the entirety of the science which it serves. No experimental psychology existed until the day of Fechner and Wundt, so that we would be compelled to make the bold assertion that a serious psychology has been developed only within the last sixty or seventy years. Such an error is possible only where there is complete ignorance of the historical facts. However modest our objectivity may be, it must be admitted that psychology (by which we mean a knowledge of the facts of human actuality, the laws of its function, and its behavior) reached a high stage of development centuries ago. Further, we must admit that experimental methods have been developed and tested since 1860-1870 by the aid of which the above mentioned knowledge could be checked, expanded, and as far as possible expressed numerically. Finally, we must emphasize that the chief result of the tendency which became predominant during this period was to create a mass of psychological institutes

and laboratories in every country where a new type of psychologist has rapidly developed and spread.

We must also remember that this type has become a powerful group of a novel structure within the social body; this type, especially in the sphere of scientific investigation, has interfered in practical education and in every form of vocational guidance; and the result has been that during the last twenty years this group has been championing, not so much a scientific principle of investigation, as the interests of a profession. This is particularly true of the United States and Soviet Russia. In these countries a dominant position within psychology in general is held by the caste of experimental psychologists, the majority of whom are inspired by a mechanistic view of the world, which leads them to select their problems in accordance with a dogma not inherent in their subject. To claim that the results of such "special studies made under a dogmatic point of view," as we might briefly call them, constitute a new psychology would be the same as if a golfer were to maintain that he was pursuing topography or geography when enquiring after the suitability of a ground for the purposes of golf.

II

What is the opposite of an experimental psychology, not in the dialectic sense, but in actual investigation as it is reflected in psychological writings? We may suspect that very remarkable replies would be given if a prize were offered for answering this question. Personally I have never yet met a psychologist who objected to experiments on principle, nor even one who did not employ the experimental method himself; thus the logical opposite, viz., non-experimental psychology has no denotation whatever.

Possibly this opposite might be described as popular, speculative, introspective, philosophical, subjectivating, etc., psychology. All these attempts to give a name to the opposite of an experimental psychology contain a flaw because they use different viewpoints to compare the two terms. None of the various kinds of psychology enumerated is compelled to renounce the experimental method; and equally, experimental psychology cannot abjure the logical methods and fundamental concepts of the types of psychology contrasted with it. All these contrasts are more or less faulty and only serve to carry the argument into the wrong field. Fundamentally the argument is

invariably concerned with mechanistic prejudices and their consequences in the selection of the problems to be solved.

Let me give two examples. If I desire to make valid psychological assertions about Buddha, Caesar, Savanarola, or Wallenstein, I shall have to do without experiments. But further, psychological assertions about our contemporaries have not been invariably described as substitutes for the results of the laboratory. Such assertions will be considered as valid judgments if made by an intelligent and capable person, or as faulty, capricious, and narrow-minded if made by a fool. Again, the causes and varieties of crime can be largely investigated only by means of the analysis of individual cases and the statistical treatment of a vast mass of facts; experiments here play a negligible part.

It may be the aim of the experimentor to eliminate error due to his, the observer's, peculiarities (apart from his "personal equation") as far as possible. Consequently it must be his aim: (1) that every experiment shall be repeated in relatively invariable circumstances; (2) that all the essential factors in the object of the experiment can be seen and observed in the experiment (very frequently it will be here alone that they can be seen and observed); and (3) that all or at least most of the factors can be measured and numbered. This aim clearly implies that he is following the methods of physics and chemistry; but the pursuit of such an ideal is due merely to a mechanistic prejudice. It is often asserted that in psychology the experimental method has the same advantages and disadvantages as in every other sphere. This is certainly wrong. The experimental method is suitable for the investigation of all the processes which we can cause at will, and consequently it is useless for the study of unique events, forms and values, and this is the more so the greater their spontaneous effect. Again, the experimental method is suitable for investigation of work and individual functions and this is the more so the closer these are to the sphere of physics and chemistry. This condition is best fulfilled by a part of biology and physiology, but the higher animals and especially man create great difficulties in the way of the necessary uniformity of the conditions under which the experiment is made, so that the result compared with those of direct observation are sufficiently modest even if we disregard the difficulties of interpretation. And yet, the real task of psychology only begins with interpretation, a fundamental fact which we must not allow to be obscured.

Certain schools of thought still maintain the central mechanistic thesis of the late nineteenth century, or even proclaim it as a new discovery, viz., that the only valid facts are those which are experimentally demonstrable on the lines of stimulus-reaction. To this we should reply with even greater emphasis that no cruder prejudice has probably ever been spread in the name of science.

This curious fiction, which renders its victim so blind to the riches of psychological happenings, practically amounts to the pretence that by the side of the technical inventions of the last decade (motor cars, wireless, cinema, etc.), another discovery was made with regard to man himself—a method of thought and calculation by means of which man could be not only tested and understood but also perfected more or less in the same way as those other machines or contrivances. Again and again we shall discover this mechanistic daydream about man lurking as the chief motive behind the argument of psychologists who have made a temple of their laboratories and a dogmatic system of their methods.

III

If we wish to show more clearly the proper part to be played by experiments in psychology, we must begin by pointing out the appropriate object of psychological investigation. This object must not be confused with those of other studies; it is fundamentally different, e.g., from the entire sphere of physics, while on the other hand it stands close to or is even founded upon all those events which we observe in non-human living beings. I should like to quote here the decisive definitions contained in R. Pauli's *Experimentelle Psychologie* (Leipzig, 1927), an able work entirely free from the pride of psychological absolutism, because this will show how small initial errors may involve mistakes from which it is difficult to free oneself later. Pauli goes beyond the general definition according to which the object of psychology is "experience as it is given immediately and completely," substituting for it "vital processes immediately experienced." Unfortunately the author describes psychology as "the science of the subjective vital processes" and thus allows himself to be bound by an erroneous tradition. If he goes on to speak of "a law connecting the subjective vital events with objective organic events," he is inevitably led to the wholly erroneous assertion that "the distinction between psychological events and scientific events and

hence also physiological events, consists in the degree in which they can be approached."

A completely different view has been held since the time of Nietzsche by certain psychologists headed by Klages to the effect that soul events cannot be separated from vital events and can therefore only be studied if the latter are carefully taken into consideration. This implies the unity of body and soul and puts an end to the useless attempt to solve the problem of the parallelism or interaction between body and soul, the principle of expression being substituted for the causal principle. As soon as this principle is understood in the significant sense given to it by Klages, we realize why most of the questions asked by experimental psychologists have remained fruitless, the reason being that they followed the analogy of physical events and rashly applied the causal principle where the principle of expression should have been employed. Once we have adopted the new view of the living entity, according to which it is a functional system having body and soul for poles, to which is added in man a new dimension in the shape of the system of spirit (consciously willing ego), we are compelled to relinquish the mechanistic faith which explains the complicated processes facing the psychological student on the lines of stimulus-reaction.[1] Simultaneously we lose our pious faith in the power and wisdom of the apparatus, the tables, and the experimental figures, and instead (as Pauli does with commendable emphasis) we shall commence from the sound principle that every experiment not only presupposes a full command of the psychological observation but also, more or less, of the entire facts which are at issue; it presupposes their knowledge but does not produce them. We shall then also be able to form a correct opinion of the principle that every experiment is an observation directed upon an event which is not natural but arbitrary. It will then be impossible any longer to believe that the facts which can be repeated in the experiments can not reproduce the essence of the event in question; it simply consists in projecting one aspect of the event on to an artificial scale of measures which can be applied more or less arbitrarily to this one isolated aspect and consequently is valid only

[1] The first consistent application of Klages's discovery is to be found in my *"Leib Seele Einheit" Ein Kernproblem der neuem Psychologie* (Potsdam, 1927) and *Psychotherapy. Its Nature, its Application, its Limitations* (J. Cape, London, 1932). Also *Charakterkunde der Gegenwart* (Berlin, 1931), especially chapter IV: "Methoden der Charakterforschung," and *Persönlichkeitspsychologie, Entwurf einer biozentrischen Wirklichkeitslehre vom Menschen* (Leipzig, 1932).

by analogy or in an abstract sense. We mentioned above that psychological experiments differ from physical experiments in that they allow us in the main to investigate only details; we can accordingly sum up as follows.

IV

To make an experiment means to test functions and behavior under artificial and controlled conditions. Its task in psychology is to check in detail certain events and acts known by direct observation. In certain cases it allows us to isolate the physiological aspect of events so far that we can measure them. It also allows of a more delicate analysis of events qualitatively; this applies chiefly to those events which can be apprehended by the senses. On the other hand it is comparatively inefficient as applied to memory, feelings, thought, and volition, especially as compared with the wealth of knowledge reached by other methods. It allows us to make practical tests of comparative efficiency by means of which we can form an opinion upon talents and vocational aptitude.

The limitations of the experimental method begin at the beginning of psychological understanding proper, the aim of which must always be a valid and complete apprehension of man as a whole and all his complexities. Experiments can help us in fashioning the bricks for a structure, the outline and execution of which demand different methods and capacities. This gives us the ultimate limitations of experiments in psychology: they do not provide us with a method for manufacturing new knowledge and they only give us methods for checking partial knowledge already existing; also, unfortunately, they allow us to obtain an apparent confirmation for erroneous beliefs. If the population in another country should insist that there is no difference in talent between men and women or again that there is no difference in individual disposition, there would be no lack of experimental methods furnishing us with proofs of such a dogma. Those who are blind to the unique gifts of a Beethoven might be able to discover by means of tests that he was a man of less than average practical intelligence, abnormally labile, and socially inferior.

In short, psychological experiments provide us with clear results only where mean or average values are compared with regard to individual functions or individual efficiency. Anything above the

average lies beyond experimental investigations, since we are now dealing with a qualitative instead of a quantitative change which must be judged and not measured. A kind of biological fatality has caused investigators to be themselves as blind to values as is their apparatus, a fact which does not diminish their merit within their proper limitations. In the sphere of human personality isolated functions rarely play a part outside the laboratory; it is always the entire system of body plus soul under the guidance of spirit-volition, which functions in the other world, the manner of its functioning being an interplay of spontaneous and reactive events. Hence the importance of experiments must diminish, the more we study the individual as a full personality in his everyday surrounding. This is the reason why the experimental method has been comparatively useless in the educational sphere, including psychotherapy and priestly care, as well as in the sphere of the practical and theoretical investigation of human individuals.

We must here mention another fact generally neglected although it is of fundamental importance in limiting the sphere of experiments as applied to man. In a mature personality values are judged in accordance with a sense of responsibility towards some power acknowledged to be super-personal; on the other hand in inter-human relations values are judged in accordance with the tendency to find and to respect similar values in others. As soon as I make others the object of an experiment I neglect these values and put the others on the same level with an animal experimented upon while myself retiring to the level of the representative of a higher knowledge or of "objective contemplation." Ordinary human intercourse implies a measuring of forces and consequently risk (this also applies to commanding and obeying) and it implies a kind of responsibility for the integrity of the other; but if an experiment is conducted, this relation is relinquished and the experimentor, whether he wills and knows it or not, adopts the attitude of a *magician*. Perhaps it is necessary to have had psycho-therapeutic experience and the knowledge it brings in order to understand this problem correctly. Any introspection, including every kind of expression, leads among other things towards the awakening of a tendency towards decisions; and this tendency becomes clearer and stronger the more closely the act of introspection concerns the nature of the person and his self-development. Hence most psychologists rightly hesitate to make

experiments in the religious, erotic, and ethical sphere. The studies made by E. D. Starbuck and his school show that valuable details can be discovered in these difficult spheres if there is present sufficient maturity, skill, and authority; but similar experiments would certainly yield absurd results if made by a simple believer in experimental absolutism.

A sound and correct psychology aiming at a maximum degree of truth relating to man will mainly depend on the personality of the psychologist and the width, scope, and critical depth of his knowledge, a knowledge acquired in many different ways. Experiments are an aid or instrument and can never be a substitute for psychological thinking but must subserve the latter within their own narrow limits.

THE STUDY OF PERSONALITY BY THE EXPERIMENTAL METHOD

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Ninety years ago John Stuart Mill brusquely repudiated the experimental method as entirely unsuited to the study of human personality.[1] To prosecute experimentation in this field, it would be necessary, he thought, for the individual child to be brought up and educated in complete isolation, so that every conditioning factor could be known and controlled from infancy to a mature age. Needless to say, Mill's conception of what constitutes a psychological experiment was much more rigid and exacting than that which prevails today.

Fifty years ago Sir Francis Galton expressed a point of view exactly opposite to that of Mill.[2] For the first time in the history of psychology Galton explicitly proposed the method of scientific experimentation in the field of personality. "Emergencies," he wrote, "need not be waited for, they can be extemporized; traps, as it were, can be laid." And he added the following example. "Thus when two persons have an 'inclination' to one another, they visibly incline or slope together when sitting side by side, as at a dinner-table, and they then throw the stress of their weights on the near legs of their chairs. It does not require much ingenuity to arrange a pressure gauge with an index and dial to indicate changes in stress, but it is difficult to devise an arrangement that shall fulfill the threefold condition of being effective, not attracting notice, and being applicable to ordinary furniture. I made some rude experiments, but being busy with other matters, have not carried them on, as I had hoped."

Galton well knew that experimentation is an exacting method, requiring not only precise observation, but also such control as admits the isolation and variation of conditioning factors. He knew that experiment requires that two variables only be studied at a time:

[1] *A System of Logic* (1843), VI, chap. 5.
[2] *Fortnightly Review*, XLII (1884), 179-185.

one, the dependent variable, is measured in order to determine whether its change is a function (and presumably a consequence) of change in the other, the independent, variable. But still Galton did not despair. He had seen the experimental method rigidly and profitably employed in the laboratories of psychology for the study of intellectual and motor processes, and had followed with interest its revelation of individual differences in respect to these processes. He could find no reason to exclude so fruitful a method from studies of "characterial" differences.

It is only in recent years, however, that Galton's proposal has been put to test, with results which do not entirely confirm his optimism. When actually applied to personality, the experimental method has disclosed many weaknesses not foreseen by Galton nor encountered by the laboratory psychologist in his ascetic study of the simple, non-personalized functions of the human mind. These weaknesses are so striking that they have caused many present-day psychologists to reject entirely, as Mill did, the possibility of experimental work in a field where the variables are neither simple nor common to all men, but complex and often peculiar to each person.

Critics of the experimental method point out, quite rightly, that some of the factors which are crucial in the formation of personality completely defy experimental study. How, for example, can experiment measure, or in any other way treat, the effects of emotional shock, feelings of guilt and inferiority, religious conversion, sexual encounters, grief, ambition, loneliness, love, or despair? The truth is—Galton to the contrary—that none of the radical emergencies of life can be extemporized. Many areas in the broad field of personality cannot be approached at all through experiment.

But critics have not been content with pointing out the frequent inapplicability of the experimental method. They have heaped other indictments upon it. They maintain that the abstraction of single variables for the purpose of measuring their change when surrounding conditions are altered, leads to a weary waste of fragmentary results. They say that this procedure creates nothing more than débris which can never be assembled by the experimentalist or by anyone else. From the products of an analysis the individual cannot be re-created. In studying single variables the experimentalist loses the very object of his interest, for personality is interstitial, existing only as a *relation between* the segments which the experimentalist

selects for study. And finally, they point out that experimentation aims at measurement, whereas one cannot measure what is qualitative and unique.

These formidable objections are not incontestable. They apply with force only when the variables which the experimentalist selects are too narrow or otherwise ill-conceived. It is true that a variable that is too fragmentary or chosen at random must not be expected to show any appreciable relation to variations in personality. For example, the graphic habit of dotting *i*'s far to the right, taken by itself, should not be expected to serve as a conclusive index of any characteristic of personality whether broad or narrow. And yet experiments purporting to disprove graphology have made just such assumptions. In other studies it has been found that the acidity of saliva or the color of the hair bears virtually no relation to an individual's aggressiveness. But whoever supposed that it would? In still other studies, haphazard rating scales and tests have been employed with a view to determining their relation to equally haphazard variables in personality. Necessarily low correlations have resulted which have given the careless experimentalist grounds for claiming that personality is unorganized and all conduct specific. This conclusion, so opposed to everyday experience and to common social and educational policy, is soberly accepted and widely disseminated.

But it is unreasonable to condemn the experimental method simply because it has been misapplied. There have been experiments, far more successful, which have not proceeded with the futile assumptions that hit-or-miss concepts are a good enough starting-point for research, and that in order to secure accessible variables it is necessary to select those which are so elementary and minute that they bear no sensible relation to the structured organizations of personality. In one of the better experiments *complete* descriptions of certain individuals were matched with the *form-quality* of their handwriting. This simple procedure permitted of such control that no fraud, no extraneous cues, no looseness of terminology, nor chance, could affect the results. It was in every sense of the word a scientific experiment. Yet it did not deal with "meaningless fragments" nor destroy the *patterns* which are the very essence of both the inner personality and its forms of expression.

Successful experiments also have determined the ability of people to judge others on the basis of their first impressions, and have

established some of the conditions which make a person a good judge of others. The correspondence between graphic movement and voice have been studied, between gait and gesture, and between forms of verbal expression and artistic creations. Other experiments have studied the consistency of dominant or aggressive behavior when a certain child is paired successively with many other children, when he is at home or at school. Still other experiments have shown that a man's interests exert a widely diversified influence upon the speed and certainty of his judgments. In all these instances, and in many more, the requirements of the experimental method have been met successfully, and the structure of personality, far from being obscured, has been definitely clarified.

It must not be thought that experimentation is identical with the quantitative method. It is, in fact, a much narrower method. Astronomy can employ intricate quantitative techniques without being able to experiment. Similarly, many problems in personality inaccessible to experiment can be approached quantitatively. Exact observation with an enumeration of responses, rating, questionnaires, the analysis of case-records in clinics or courts, involve quantitative methods, but not experiment. The point at issue is the defense not of quantitative methods in general, but of experiment. Nevertheless many of the arguments both pro and con apply equally to both methods.

Nor should experimentation be considered co-extensive with "tests." Just as experimental study is only one division of the broader quantitative method, so are tests only one branch of the experimental method. It is not always clearly understood that tests are essentially abbreviated and standardized experiments. The point, however, has been convincingly established by Terman.[3] If a test is ill-conceived and carelessly constructed, it is simply a bad experiment; if it is psychologically sound and adapted to the problem in hand, it is a good experiment. Undoubtedly the chief requirement for improved testing today is an improved logic of traits. The authors of one recent scale have undertaken an experimental and empirical check upon the validity of Spranger's classification of human values.[4] Their work in the main has substantiated some of Spranger's claims (disclosing, however, the weakness in his concep-

[3] *Psychological Review*, 1924, pp. 93-117.

[4] P. E. Vernon and G. W. Allport, *Journal of Abnormal and Social Psychology*, XXVI (1931), 231-248.

tion of the *social type*). This test is really an *experiment* in the complex field of human values, and proves that the experimental method illuminates even those deeper recesses of personality which have been considered impenetrable to all methods other than *Verstehen*. It has shown that formal or "ideal" types may at the same time be *real* types, and this demonstration was possible only through the careful application of empirical techniques to a pre-existing hypothesis. No matter how entrancing an hypothesis concerning personality may be, it must either submit to some concrete test and be verified, or else it must sooner or later depart to the land of solipsistic fantasies.

The psychology of personality is still a new field, and at present it is struggling for more and more suitable methods by which to verify its a priori hypotheses. Quantitative methods, experimentation, and tests are widely tried, sometimes with success and often without. When they fail, it may be because they are not suitable to aspects of personality to which they are applied. Most of the failures, however, seem to be due not so much to the inherent inapplicability of these methods, as to their unskillful conception and misapplication. If certain precautions are observed, they can be improved and employed with great profit.

The case for direct experimentation can be re-stated briefly along with certain rules for its proper use.[5] In so doing a kind of methodological credo results which if carefully followed should inspire the experimental investigator with both a suitable courage and an indispensable sense of caution.

(1) The "total personality" is a pleasing and seductive concept, but for the psychologist it is as vain and inaccessible a problem as "total consciousness" or the "total soul." Some sort of analysis is essential for scientific study.

(2) On the other hand, mere fragments of behavior (such as are yielded in Symonds' analysis of tact into 1173 habits[6]) are quite irrelevant to the problems of personality, for personality is composed of complex, well-structured systems of attitudes and traits. It is these complex systems which must be distinguished for successful experimental study.

[5] Some of the following items were suggested by W. Wolff in his plan for an "experimental-dynamic" methodology. *Gang und Charakter* (edited by H. Bogen and O. Lipmann), *Beiheft zur Zsch. f. ang. Psychol.*, 1931, No. 58.

[6] *Journal of Educational Research*, XXI (1930), 241-254.

(3) These broad and meaningful variables must be studied under controlled conditions, and all disturbing factors eliminated. If this precaution is not taken, it will be impossible to tell whether the behavior is an expression of personality or only of extraneous influences.[7]

(4) Exact reproducibility of experiments is never possible in psychology, but approximate reliability can be assured through the use of several experimenters, many subjects, and as much repetition as the situation permits.

(5) The conditions of the experiment should invite activity as spontaneous and natural as possible. If the experiment is a test, the items on the scale must be natural, familiar, and unambiguous. If the experiment involves apparatus, the instruments should be unobtrusive. The experimenter should be able to create an atmosphere that is both easy and at the same time impersonal.

(6) No experiment should be undertaken without a well-defined hypothesis. Only a clear-cut perception of the problem and a certain tentative anticipation of the results will avoid the confusion arising from excessive empiricism. Mere measurements in themselves are never of value. They must be examined in the light of the pre-existing hypothesis, and must serve as a basis for its reconstruction or for its transformation into a definite theory, or perhaps, even into a law.

(7) No single method will reveal personality in its entirety. Therefore the wise investigator will not scorn the study of case-histories and diaries, ratings, biographies, correspondence, introspection, questionnaires, clinical records, psychoanalysis, clues from expressive behavior, or drama and fiction. Nor will he dispense completely with his own "intuition."[8] When experiment is clearly applicable, and when it can be skillfully employed, it is undoubtedly a method to be preferred above all others, but in the field of personality it should not be expected to solve every problem nor to make the final pronouncement upon every issue.

[7] *Cf.* G. W. Allport and P. E. Vernon, *Studies in Expressive Movement* (1933), p. 22.

[8] The writer has treated this method separately in "The Study of Personality by the Intuitive Method," *Journal of Abnormal and Social Psychology*, XXIV (1929), 14-27.

INDIVIDUAL PSYCHOLOGY AND EXPERIMENTAL PSYCHOLOGY

ALFRED ADLER

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Individual psychology is compelled to adopt a friendly attitude as soon as it begins to consider the various sciences and scientific tendencies. It takes up what may be described as a central position among the various schools of psychological thought and it admits the claims of every school provided that it is seen to pursue what must be the aim of every science, namely, the promotion of human development. It is one of the fundamental claims of individual psychology that this development requires a fostering of the social feeling. For this, and various other scientific reasons, individual psychology is committed to an uncompromising position on psychoanalysis—to give but one example of a science which follows laboriously in the rear of individual psychology which, in its turn, has its sphere of activity at the very centre of human evolution.

The claims of individual psychology to describe personality and character, not by means of the inevitable ambiguity of words and concepts but by means of detailed descriptions, stand and fall with the fundamental assumption that mankind in general, as well as individuals, behaves "correctly," "normally," "reasonably," "intellectually soundly," if it possesses these qualities at any given moment *sub specie aeterna* and if it be seen from the point of view of an ideal community. In that case every aberration would have to be ascribed as an erroneous attitude; and the fact that this ideal may never be attained and that mankind is compelled never to do more than laboriously approach it, does nothing to invalidate the certainty of this view. And it may well be that every scientist is aware of this fact without necessarily understanding it.

Accordingly whenever we pass judgment on an individual—and every individual is unique; whence the justification of the term "individual psychology"—four main questions must be answered; these

questions must be supplemented by other and more detailed questions if the investigation is to be at all exact.

1. In what direction does the evolutionary urge of the individual under examination tend? The significance of this question in my science has been clearly set out in the discussion of aims in the life of the soul and of the urge towards perfection (taken as an individual perfection). This view, I imagine, has today been adopted by all serious psychologists and psychiatrists, under such names as purposivism, teleology, ideal-ego, etc., although no adequate description of this urge has been given outside the range of individual psychology.

2. This perfection which must be the aim of the individual has only one standard of measurement, viz., the ideal of a community. Accordingly what we have to measure is a relation. In our view of the inviolable unity of the individual this relation is one between his various traits (all of which are to be taken solely from the social point of view) and all the other forms in which his psyche finds expression. In this question individual psychology expresses a judgment of values and in doing so it is doing the same as every other science which attempts to substitute the better for the worse. In this science, more perhaps than in others, any error of the object of investigation due to his creative force takes up the foreground of our study.

3. We have to reject typology as being inadequate to emphasize the uniqueness of a personality. Again all the formulae, numbers, and classification, by whatever means they are reached, can only be treated as statistical probabilities and should be used only in order to throw light upon the sphere within which the personality for which we are looking may be found. It is the exact agreement between the part and the whole which is decisive for the final result of the investigation. A result once discovered may be considered as confirmed only if all the partial movements, thoughts, feelings, volitions, and attitudes (as referred to the main questions of life in the social sense) which we think we have "understood' agree with the totality of the individual within the meaning of 1 and 2. Adequate investigations of this kind have hitherto been made only by individual psychologists, and they have been available for some considerable time. The degree of social coöperation is most clearly expressed in connection with vital questions which imply a serious problem for

the individual on account of his style of life. Artificial questions can touch the sore spot of a style of life never or only by accident. Accordingly the decisive problem for us is to discover the sore spot, in other words the error in the style of life.

4. Life, with some few fortunate exceptions, tries each individual and tests his preparation for the evolutionary meaning of life. I have investigated these questions and trials in every conceivable situation and have discovered that they invariably imply the necessity of coöperation.[1] If there is failure of any kind it invariably arises in connection with the question whether the individual is fit for the community, when it is seen that this is not the case. Question 4 now arises: "Why is that so many men do not possess an adequate social feeling?" I was able to discover that the full measure of social feeling is reached in the very earliest years and that it can be augmented only if the individual recognizes the inadequacies in the structure of his style of life. The capacity for developing a social feeling is absent only in the feeble-minded. With other persons the obstacles which stand in the way of a fairly adequate development of social feeling appear clearly in the course of this investigation and, once they have been discovered, provide us with the possibility of understanding how it is that they have acted as a barrier preventing further development of social feeling. Among these barriers both of a fundamental and of an accidental nature, an important part is played by the spoiling of children; when a child is spoiled his interest is drawn away from real life.

Thus for individual psychology the past life of the individual and any interruptions it may have suffered become the central point of the investigation. Extraneous causes here appear as definite as regular tests. On the other hand experiments do not assume a more scientific appearance and in fact look only like a shadow of reality. Nevertheless it follows from our previous remarks that they can provide good results for students trained in individual psychology, and that, not only with regard to the characterological level of a group; they also allow them to understand the individual, since the results which have been reached can be further tested. It is possible to demonstrate that they agree with other forms of expression and with the individual personality, as well as to determine the unvarying distance from the ideal social feeling.

[1] (A. Adler, *Der Sinn des Lebens.* Epstein: Vienna, 1933.)

THE HANDWRITING OF IDENTICAL TWINS REARED APART

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In studying the physical and mental traits of identical (monozygotic) and fraternal (dizygotic) twins, with the view of establishing how far their personality has been shaped by genetic and how far by environmental influences—or how far the one influence has or has not altered the other—we may well turn first to those cases where an identity of inherited traits has been established and where various environmental influences have had full play.

A study of similar twins reared apart will, in time, most probably supply us with the answer to many questions deeply connected with vital problems of human society; because in such cases the thousandfold experiences of life have made their imprint upon a similar, or perhaps even identical, groundwork of Nature. In identical twins reared apart the similar inheritance of each twin has been moulded by a different routine of daily life, by differences in climatic conditions, food, bodily training, education, professional tasks, ambitions, disappointments, success or failure, married life or celibacy, childbirth or sterility, wealth or poverty, good or bad luck, town or country life, war or peace.

Now, if it were possible to study thousands of cases of identical twins separated shortly after birth, then the examination of those tens of thousands of cases of twins living together for the major part of life (an examination in which biologists, geneticists, psychologists and educators are engaged all over the world) would lose its present importance and become merely a subsidiary study of the main problem.

Unfortunately this is not possible. So far only thirteen identical twin-pairs reared apart have been traced, and of these only eight have been described. Naturally, so small a number precludes far-reaching and broad conclusions.

Therefore, with such a sparsity of material, we can only in a general way, and in all humility, suggest a working hypothesis to make our present provisional findings comprehensible, or point to some *leitmotiv* which, in our view, dominates the psychology of all these rare twin cases which have thus far been examined.

The thirteen 'reared apart' cases referred to are:

(1) Anna and Corinne. Age 25; separated at sixteen months. Their record is published for the first time in the present paper. (Case 24 of our study).

(2) Leta and Lota. Age 21; separated at twelve months; met rarely in the course of the following nineteen years; re-united at 20. Born blind. Their record is published for the first time in the present paper. (Case 3 of our study).

(3) Ronald and Dennis B., age 20, separated 1 month after birth, re-united at 10 years. A description of this case will be printed in one of the next issues. (Our case 109).

(4) "B" and "J." Age 30; separated two weeks after birth, first saw each other at 18 years. First published by Professor H. J. Muller (as Case 6 of his study).

(5) "A" and "O." Age 19½ years; separated at eighteen months, and lived apart (with one short exception) for seventeen years; studied one year after they were re-united. (Described by Professor H. H. Newman as his Case I).

(6) "E" and "G." Separated at eighteen months, and adopted by families living in different parts of Michigan. When 21 they came together and have remained associated ever since. "G" has enjoyed higher education. Lived together for several years before examined. (Newman's Case II).

(7) "C" and "O." Age 27; separated at two months; met in 1927 for first time. (Newman's Case III).

(8) Mabel and Mary. Age 29; separated at five months. (Newman's Case IV).

(9) "B" and "D." Age 38; separated at fourteen months; lived together for only one year, at the age of 20. (Newman's Case V).

(10) Ada and Ida. Separated at three years; re-united at age 16. (Newman's Case VI).

(11, 12, 13) Three pairs examined, but not yet published, by Professor Newman.

Of these thirteen cases, two will be discussed in the present paper, and others analyzed in further issues of this journal.

ANNA AND CORINNE

ENVIRONMENTAL HISTORY.—These twins (orphans) were separated at the age of one year and four months, and were not aware of each other's existence until they were thirteen. They know noth-

ing of their parentage or place of birth, or even their real names. At their separation they were adopted into different families, and given the respective family names of their foster-parents. The adopting families were both of average economic and cultural level. Anna's foster-father was a printer, who lived in L——, North Carolina. Corinne's foster-father was a grocer, who lived in R——, North Carolina. Neither family had any other children, and both environments were very happy and favorable to all-round development. Anna and Corinne were, however, treated indulgently, and at the age of thirteen had—in their own words—become "rather spoilt."

At thirteen—the first time that their guardians had been able to get in touch with each other, or that either sister was aware of the other's existence—they were re-united. For two years they now lived together, residing in the winter with Corinne's foster-parents, and in the summer with Anna's.

At the age of fifteen they were again separated for nearly two years. During this period Corinne was attending a high school in her home town, and remained there for four years until she graduated. During this time Anna was attending a high school some two hundred miles distant, and the twins saw each other only infrequently. They lived together during the ninth and tenth years of their school career, and attended the same high school while residing in the home of Corinne's foster-parents. In the eleventh school year, Anna went away to West Virginia for the first half-term, returning to the North Carolina high school again with Corinne for the last half. Naturally, under such differing educational regimes, their studies and credits varied to the extent that their educational records were not as identical as might ordinarily have been expected, though, even so, there was no great difference. Corinne's credits were, on the whole, slightly higher. From the age of seventeen to nineteen the twins attended together—for a year and a half—a preparatory college in North Carolina.

During childhood, between three and seven, Corinne had the diseases of mumps, measles and whooping cough; but Anna only the two latter. Anna's health was, on the whole, better than her sister's during this period. At the age of nineteen Anna married, and has since had two daughters. Corinne married at twenty, and has had a daughter and a son. Up to the time of her marriage, Corinne's

environment was about parallel to that of her twin-sister from an economic and cultural point of view; but since her marriage Corinne has been in a better financial position and has travelled rather extensively. At present she is living with her husband—a native of Holland—in Tanganyika, Africa. Anna married a civil engineer—a native of North Carolina—and has since lived in a rather isolated small town in Louisiana; returning only rarely to North Carolina to visit her foster-parents. The sisters have not seen each other for the past three years.

PHYSICAL CHARACTERISTICS

	ANNA	CORINNE
Height	64 inches	67½ inches
Hair color	Brown	Same
Hair form	Fine and slightly curly	Same
Hair whorl	Clockwise at apex of crown	Same
Iris color	Brown	Same
Skin color and texture	Good color but not florid; skin smooth and fine	Same
Ear shape	Practically identical	
Dextrality	Right-handed	Same
Features	Face broad, nose medium size, chin truncate and prominent, mouth large, lips medium thick.	Same
Expression	Eyes bright and alert, smiles easily. Similar (though in photo both Corinne and her child smile more freely—with open lips—than Anna and her infant).	
Dentition	Teeth very similar in size, quality and configuration.	
Voice	Very similar	

INTERESTS

When asked independently to check from a list of twenty interests those about which they were most enthusiastic, they confessed to the following:

ANNA

Athletics and outdoor activity; reading; natural history; domestic or household activities; social activities; languages; botany.

CORINNE

Athletics and outdoor activity; modelling (though without training); domestic and household activities; reading; drawing; languages; botany; chemistry.

DESCRIPTIVE TERMS

When asked independently to check from a list of fifty descriptive terms those which to their minds would most adequately describe their mental traits, they selected the following:

ANNA

Active; healthy; timid; optimistic; stubborn; good will-power; good self-control; good common sense; reasonable; happy disposition; kind; neat and cleanly in habits of dress; thoughtful.

CORINNE

Cheerful; healthy; stubborn; good-natured; thinks that her sister is more vivacious than she. Thinks that she displayed better self-control formerly, and that her sister has more common sense. Neat and cleanly in dress habits. Thinks that her sister is more thrifty than she, and explains this by environments, her sister's foster-mother being thrifty, whereas hers was not. Corinne thinks herself very extravagant at times.

DESCRIPTION OF CORINNE'S HANDWRITING.—One of the chief characteristics of Corinne's handwriting is that its size changes with the size of the stationery she happens to use. Anna also mentions Corinne's "two different hands" in one of her letters. Therefore, we present specimens of each of her 'hands' (Figs. 1 and 2.)

WHAT IS THE DIFFERENCE BETWEEN CORINNE'S TWO CHIROGRAPHIES?

(1) The size of the characters.

(2) A more distinct spacing between the lines (vertically) and a somewhat wider spacing between the words (horizontally), where a greater space was allowed.

(3) A narrow left-hand margin in the smaller script (Fig. 1), and a wide left-hand margin in the other. This margin decreases (Fig. 2), however, as the letter proceeds towards the bottom of the page. On all following pages of the larger script (which for lack of space cannot be reproduced here) the left-hand margin is as narrow as on the small pages.

(4) The small script shows numerous symptoms of self-consciousness or uncertainty, e.g., some characters are re-traced; note the last word in the tenth line (*w*onder), the name in the middle of the seventeenth line (Marthy), the second word in the last line (*w*ho); whereas her large script does not show any tendency to re-tracing.

(5) Consistency is inherent in all features of the writing, with the exception of size—which varies according to the size of the stationery, but remains consistent also in this respect once the writing has begun.

WHICH FEATURES ARE COMMON TO BOTH OF CORINNE'S STYLES? —The slanting style, the 'natural' and spontaneous writing (as contrasted with Anna's more artificial, deliberate and rather ostentatious calligraphy). A rapid and fluent tempo, slight, but somewhat irreg-

April 16th

Dearest, darling:—

Here are some pictures that were taken in Kenya. That's the next country to Tanganyika, you know. They are very lovely, aren't they? So is this country, especially here where we live. I know you'd love it here.

I had such such a wonderful mail last night—a letter from Evelyn Mullen—she's so nice and writes more often than some others that I really expected to hear from often; a letter from Josephine and one from Martha Jane—bless her heart—one from a Mr Ernest Seeman from Duke University who wants to study sister and me because we are identical twins who lived apart—you know

FIG. 1. Corinne's handwriting (natural size).

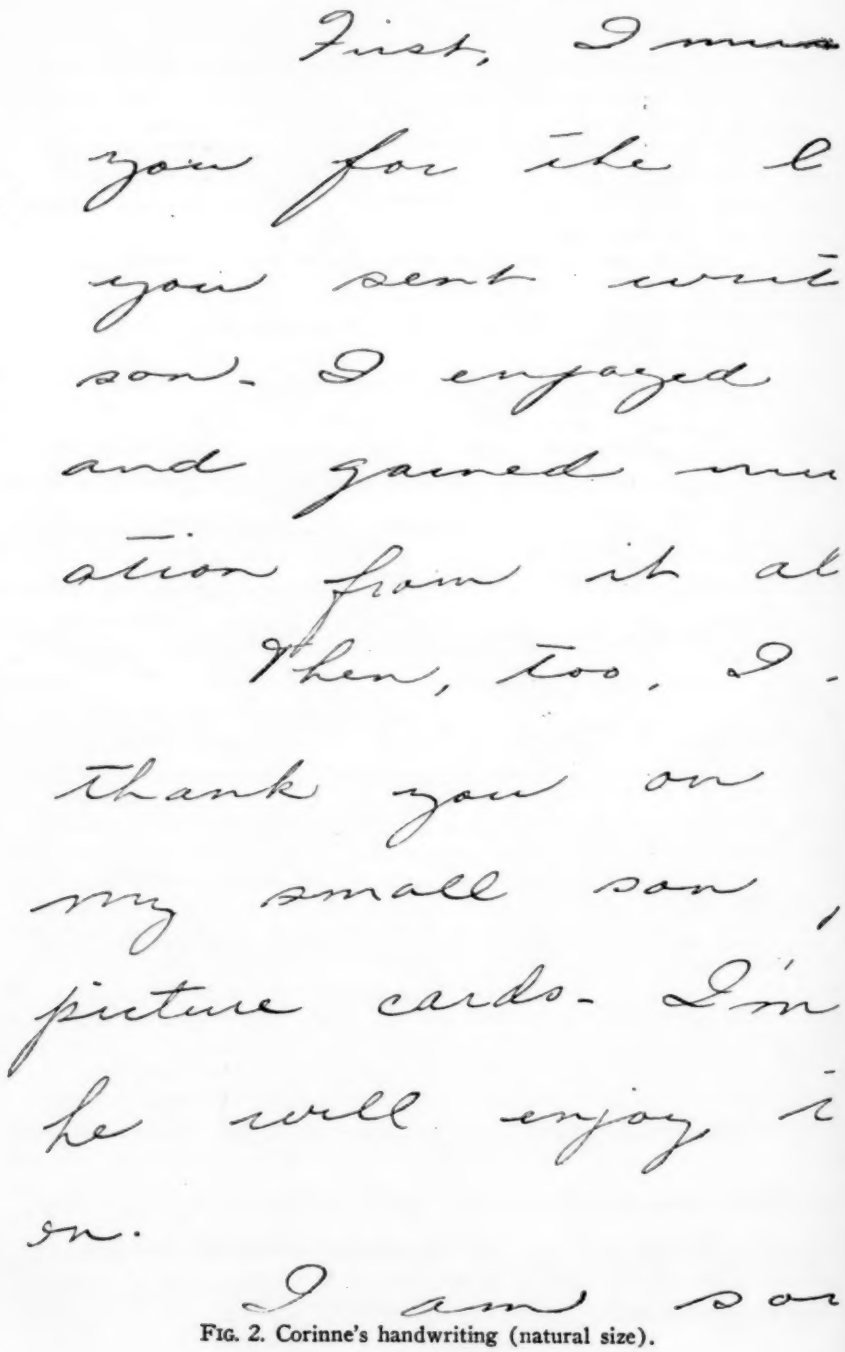

FIG. 2. Corinne's handwriting (natural size).

ular, writing pressure. The width, the slight 'lability' in the shaping of the inconspicuous parts of some characters, the direction of the lines which tend downwards; the fact that the writing covers the whole page and does not allow for any margin at the bottom. The distinct, plain, and simplified forms of the characters and consistency in the style, with hardly any contradictory features.

PSYCHOLOGICAL CONCLUSIONS FROM THESE FEATURES IN CORINNE'S WRITING.—An intelligent, zealous woman, efficient in the daily routine of life. Spontaneous; of a lively temperament, but always natural and without pose in her behavior. Adaptable to changing conditions; sincere in her utterances; a good companion who enjoys pleasant small talk about something or nothing. Very impressionable—sensitive and responsive—; good-hearted and understanding; helpful and inclined to trust others, and hardly ever suspicious. Enjoying the company of 'nice people,' but growing easily self-conscious should those whose 'niceness' she took for granted prove bad-tempered, unsympathetic, or scheming. Has a quickly-working power of comprehension; commonsense, though somewhat superficial in her judgment; naïve enough to take many things for granted. Given to slight depressions and to feelings of loneliness when deprived of sympathetic company.

DESCRIPTION OF ANNA'S HANDWRITING (FIGS. 3 AND 6).—A bold hand; striking, and somewhat pretentious in its style; deliberately shaped and unspontaneous. Upright and strong writing pressure; wide left-hand margin which increases towards the bottom of the page; no right-hand margin; no margin left at the bottom of the page. A marked fluency of the writing; quaint and original forms of some letters. Inconsistency in many features (which, since the style of the conspicuous parts is strongly contrasted with that of the inconspicuous ones, is only another way of saying that her calligraphy is deliberately shaped and not 'natural' in its quality).

INCONSISTENCY IN ANNA'S WRITING.—The script is conspicuously wide, but the same characters which appear wide at the beginning or in the middle of the words are noticeably narrow when occurring at the ends of words, e.g., the last word in the third line (Fig. 3, lower part) the "n" in "written" has hardly one-fifth the width of the "n" in "under" in the preceding line. Or compare the majority of "n's" with the "n's" in the word "Corinne."

Ernest Seeman
Duke University
Durham
NC.

My always [illegible] different She writes

I am sending you under separate cover a letter written to Corinne's mother & a baby picture of Corinne & the most recent snapshot we have of her that

FIG. 3. Anna's handwriting.

The script is conspicuously large (not only are the striking capitals drawn with bold movements, but some small characters are also kept in a size-ratio uniform with those enormous initials). But the same characters are much smaller in other parts of the writing, e.g., the final "r" in "cover," third line, is shaped quite differently from the final "r" in "mother" (next line), the first being simplified, high and narrow; the second amplified, short and wide. Or, the "i" in "sending" (first line), which is wide, garland-like, connected with the preceding and the following characters, and measuring 3 mm.; while the "i" in "picture" (fifth line) has neither a garland, nor an arcade, nor an angular style, but is a simple dot disconnected from the preceding and the following letters, and measuring 1 mm. only. Or, the interspace between the letters within the words—even where a combination of the same or similar characters is concerned—is wide in one case and narrow in some others: e.g., in "av" in "have" (eighth line), the interspace is extremely wide, whereas in "ov" in "cover" (third line) there is no interspace whatsoever, so that the downstroke of the "v" actually forms a tangent to the oval of the "o."

The script is amplified in conspicuous parts, but is quite as often simplified in the inconspicuous parts. Note the way she does, or does not, amplify the shape of the ovals and loops, and compare the size, height, shape, and width of the "h" in "have" and of the "h" in "her" (eighth line) with the "h" in "mother" (fourth line). The first example mentioned could be read for a capital "R"; in the second "h" mentioned, the second downstroke is mutilated when compared with the enormous loop which does not allow of any space for that downstroke; then follows a normal "h" ("that," eighth line) where the loop is already much smaller. But in the word "mother" (fourth line) we come across an "h" which has hardly half the size of the other ones (though these already differ greatly as between themselves), being short, narrow, and showing an inconspicuous loop.

We notice the same inconsistency in size, height, width, amplifications (or simplifications), connections (or disconnections) in practically all twenty-five characters of the alphabet (capitals as well as small characters, though more pronounced in the latter).

CONSISTENTLY OCCURRING FEATURES.—Anna's handwriting shows the following features which are consistently applied throughout her script:

(1) Equally strong pressure
(2) Vertical style
(3) Deliberate, artificial, striking, 'smart' style. She habitually writes the "i" dots in the shape of small circles—for some time an artistic fad among American women—, though those small anti-clockwise movements certainly do not form an intrinsic part of her otherwise clockwise writing movement, with which she apparently enjoys writing arcade-like forms. Nor does she miss that other American fad, which consists in writing the word "of" without an upper-loop projection and in shaping "f's" and "g's" like the figure 8. (Compare Fig. 3, lower part, sixth and eighth line as well as Fig. 6, lines 4 and 7).

Though such strange forms have never been taught in American schools, they are conspicuous enough to be taken up by writers who, because they carry subconsciously a secret wish to appear as striking personalities, adopt odd and unusual styles as they come across them in other people's writing. The capital "I's" and the ever-changing shape and style of her signature are other instances of the same desire to express herself in an original and strikingly artistic way.

But we have further evidence for our claims that these odd, 8-like forms are due primarily to imitation rather than to psychic factors in her personality.

(a) These lower projections shaped like the figure 8 have a particular psychological significance when occurring together with certain other features, e.g., lack of pressure, lability of most features, shapeless, as it were threadlike forms, etc. Now, none of those features, which should occur together, are present in Anna's writing.

(b) Where the 8-shaped forms are expressive of the writer's personality, they do not occur sporadically but regularly, because they correspond to a definite direction of the writing movement. Now, one has only to compare the four lower projections in "g," viz., in the last word of the first line "sending" (Fig. 3) with the lower loop of the "y" in the following word "you" and again this "y" with the "y" in the word "baby" in the fifth line, and this again with the "y" in "University" in the address (Fig. 3, upper part) to see that there is no consistent tendency in any of these movements; but that they vary in a moody and playful way throughout all her script. (Compare also the various lower loops in Fig. 6).

(c) She is unable to produce a regular 8-shape whenever she has to write "ff"; then the second "f" always gets some sort of an upper projection, the bulgy ovals are replaced by angular forms, and the lower projections of the second "f" are hardly half the size of the first (Fig. 3, upper part, "different," Fig. 6, "off," sixth line).

(d) Inconspicuous final emphasis. The final strokes in many words end in a little dot. The most typical examples of this sort occur in Fig. 3, e.g., "written" (third line), "mother" (fourth line), "the" (sixth line); and Fig. 6, "much" (second line), "trouble," "have" (third line), etc.

FIG. 4. Anna.

FIG. 5. Corinne.

(4) Wide vertical spacing (between the lines)
(5) Wide horizontal spacing (between the words)
(6) Broad and increasing left-hand margin
(7) No margin at the bottom of the page
(8) Bold emphasis of "I" (the symbol of the ego), and much self-assertion (emphasis on her signature)

PSYCHOLOGICAL CONCLUSIONS FROM ANNA'S HANDWRITING.—An ambitious person, energetic in all her versatile interests, impelled by a strong inner driving power. Ever on the alert lest she should not impress people in the right way; that is in a way which would not do credit to her striking and original personality.

But then again this subconscious thought: What is the good of it, if there be no audience worth impressing? Oh, how she does crave

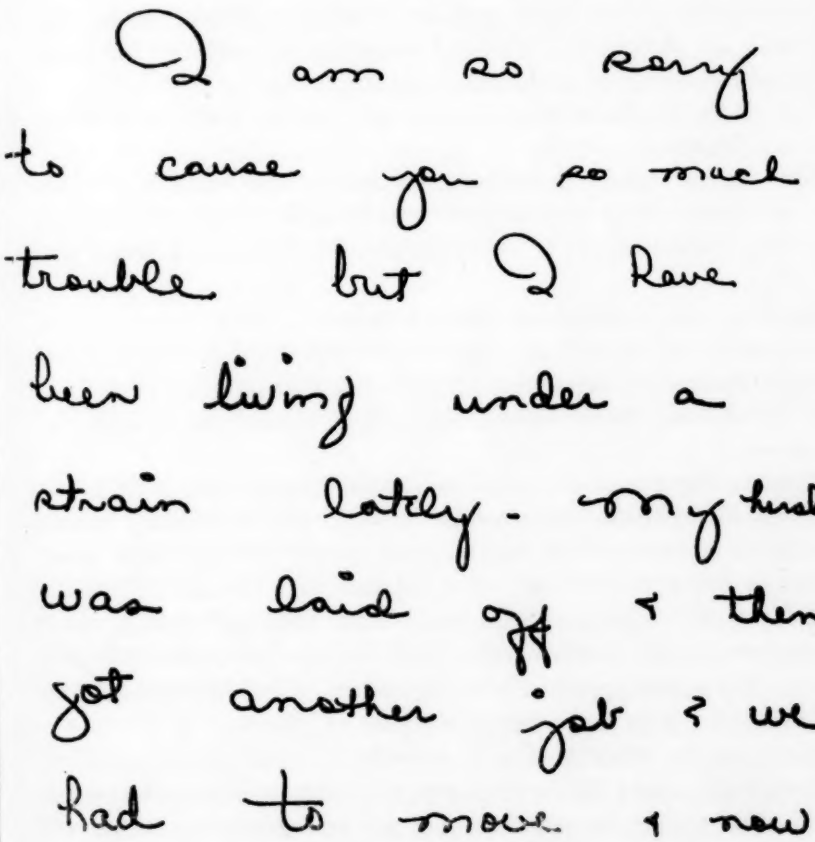

FIG. 6. Anna's handwriting.

to have a crowd of her own, some clay of society to mould, some more important audience to impress, something less provincial and really 'smart'!

Being self-conscious and exceedingly anxious to make a good impression—to be liked, appreciated, and admired—Anna expends her energy in controlling her expressions, actions, and movements. Being wistful of the success of others, she carefully, even though unconsciously, observes their behavior—especially the idiosyncrasies of those whom she thinks to be successful—and unwittingly grows into the habit of imitating them.

She feels the urge to see her personality recognized, were it only to set her own doubts at rest and to overcome her natural uncertainty and self-consciousness.

Anna is clever, intelligent, and has a refined aesthetic sense. She is capable of enthusiasm, has endurance when working for some cherished cause or aim, and strong self-discipline.

But all these admirable assets are spent on the ambition to come into prominence.

She cannot stand the monotonous and boring routine of daily life. At times she is moody and even irritable because she cannot bear the trivialities of a commonplace life without change and romance.

SIMILAR AND DISSIMILAR MENTAL TRAITS OF THE TWINS.—Both are somewhat self-conscious, slightly nervous, intelligent, and clever (though somewhat superficial in their intellectual performances). Both are sociable, like company, and enjoy friendly conversation as a pastime.

Corinne has resigned herself to a quiet family life, with a few understanding friends and a couple or so of nice neighbors; spends her life in harmony with herself, and grows nervous only when cheated in her confidence or when encountering ill-will. Normally her delicacy of feeling manifests itself in her responsiveness to novel impressions, in her understanding and in her helpfulness towards others. She would grow irritable only when barred by harshness, or shocked by irony or scheming on the part of others.

Anna, on the other hand, has not only failed to resign herself to her fate, but is, quite on the contrary, revolting against it; has made up her mind to free herself from her self-consciousness, and would like to become or to be a leader in her crowd. She enjoys the com-

pany of others, but with the thought ever present in her mind to demonstrate her value, to impress those around her by her personality, to find some new outlooks, and to watch for opportunities for the expansion and improvement of her environment.

Corinne behaves in a natural, unassuming, modest way. Pose is quite alien to her personality; she cannot but be herself, and does not see why she should pretend to be different.

Anna somehow hates her plain self, and tries hard to convince herself and others that she is something different indeed from her ordinary environment.

Corinne has not quite succeeded in overcoming all her natural shyness, and is sometimes given to self-doubts and depressions.

In the personality of *Anna,* the compensation of her self-consciousness has been overdone. In repressing her self-doubts, she has grown into the fixed habit of a self-assertion which makes her play the self-imposed part of a leading lady, like an understudy on the stage, well-prepared and ever ready to take over the part of the star and to step into the full limelight should her chance come by some stroke of luck. She may still succeed should the right opportunity come her way. After all she has a refined style of her own, artistic sense and capable hands, and has learnt the lesson life had to teach her.

Evidently some innate dispositional traits of the twins are very much alike, though even genetically they may differ. *Anna* seems to have the greater pushing power, and a sort of stubborn resistance with which she revolts not only against her environments, but also against her own nature. *Corinne* resigns herself to her own self, as it were. Environmental influences have strengthened these innate differences; have in the one case worked to a sort of helpless, but cheerful resignation, and, in the other, to discontents, ambitions and repressions.

And in the same way as the natural, unassuming, modest but slightly irritable, writing of Corinne—which so easily adapts itself to the actual means (stationery) in hand—apparently shows quite a different personality, so does the bold, big, strong, moody, inconsistent, deliberate, ostentatious (but also artistic and to a certain extent original) hand of Anna's. The latter's adaptability to given circumstances manifests itself in the moodily changing shape of the characters rather than in the size applied according to the available

space. Here again a fundamental characteristic trait (viz., adaptability) has developed in opposite directions.

Nature seems to have made both highly sensitive, responsive, self-conscious, adaptable and gifted creatures; but those dispositional traits in which they differ, together with their divergent environmental influences, have certainly shaped them into two considerably different personalities.

LETA AND LOTA

ENVIRONMENTAL HISTORY.—These twins were born in a rural district in South Carolina. Their father and paternal grandfather were both farmers, and their maternal grandfather a carpenter. They come chiefly from German stock, settled in South Carolina about six generations back. The parents are double first cousins, which may or may not (since medical authorities still greatly disagree on this question) account for the fact that the twins were born, and still remain, blind.

The twins had a brother and a sister who were also born blind. The brother is still living, but the sister died in infancy. Twinning runs in the family, and our subjects have a pair of twin cousins of unlike sex.

Leta and Lota were separated when twelve months old; Leta went to her maternal grandmother, while Lota remained with her parents. Though their homes were only about four miles apart, they were brought together only for very short casual visits in the course of the next nineteen years. When they were 20, their grandmother died, and the twins were re-united in the parents' home.

They went to school for nine years, and still attend a special school for the mute and blind. Their scholarly performances did not greatly differ, according to their school reports. They read braille perfectly, sing and play the piano well after having had eleven years of piano study. They have had some experience in broadcasting.

They are rather more alike than our photographs imply. They live in financially poor conditions, in a rural district, and no particular care is taken of their appearance—since their blindness makes them unaware of it and since they have always been very poor. They dress differently; their clothes are made up of odds and ends; so that the similarity of their appearance is rather disguised than stressed by their clothes and style of hairdressing.

FIG. 7. Leta's script.

FIG. 8. Leta and Lota.

FIG. 9. Lota's script.

PHYSICAL CHARACTERISTICS

	LETA	LOTA
Height	62 inches	65 inches
Weight	105 pounds	108 pounds
Hair color	Brown	Slightly darker
Hair form	Fine, silky, straight	Same
Iris color	Grey	Grey
Skin color and texture	Pale and anemic	Same
Ear shape	Practically identical	
Dextrality	Right	Same
Features	Heads broad, with spacious forehead; noses fairly long and pointed; mouths fairly large; lips medium thick; chins very prominent.	
Expression	Significantly at variance, as Lota's lips are parted but Leta's firmly closed; as Lota's hair nearly covers forehead but Leta's forehead is uncovered; and as Lota's expression is somewhat strained but Leta's is quite serene and with a faint smile. Another way to put it is that the corners of Lota's mouth turn down (with less sanguinity) and Leta's turn up (with more sanguinity).	
Dentition	Practically identical.	
Voice	Practically identical, but Lota's slightly more nasal, because of chronic catarrhal affection.	
Posture	Extremely similar, slight stoop and arms hanging limply.	

INTERESTS

Asked to check, in joint examination, from a list of twenty interests those about which they were most enthusiastic, they confessed to the following, after consulting with each other.

LETA

Outdoors (but not athletics); reading braille (very much); domestic and household activities; social activities; story-writing; music; botany; chemistry; mathematics; nursing. (Antipathy for history and public speaking, argument or debating).

LOTA

Outdoors (but not athletics); domestic and household activities; social activities; music; botany; chemistry; nursing; languages.

DESCRIPTIVE TERMS

Their teachers and intimate friends describe them as good-natured, calm, self-controlled, healthy and dependable girls; with good common sense, but rather shy, self-conscious, and even timid in the company of strangers. Timidity should not be regarded as a

typical individual trait, however, because it is common to most blind people.

Nevertheless, the twins agree that all the terms mentioned above describe them quite accurately; and this shows how much the mental make-up of each has in common with that of the other.

On the other hand, they think themselves, and their friends confirm it, that Leta is nervous and restless and more easily worried than Lota, who is described as not nervous, but as having a rather passionate temper.

The little bit of their writing at our disposal rather confirms the correctness of these remarks. Naturally, neither can properly write; but Leta is somewhat more methodical and certainly more capable of concentration and control of her expressive movements. She has, after all, managed to write the few lines and the signature reproduced in Fig. 7, though the "s's" are inverted, and the size of the characters is very variable, and as a matter of fact increases whenever a more complex shape is written. But the writing pressure is uniform throughout.

Lota (Lottie), on the other hand, is hardly capable of signing her name at all. She manages to a certain extent with her Christian name, but is quite hopeless when it comes to writing the name "Bonner" (Fig. 9).

It is rather remarkable that in both cases the "r" is written in a different style from the rest of the word, viz., the shape usual in cursive writing. Still, Leta has after all succeeded in writing a legible signature whereas Lota seems completely lost in her scribble, which is devoid of any style and bears evidence of great irritability.

When asked to draw "a man," Leta managed quite nicely, whereas Lota produced something looking more like a tangled skein than the figure of a man. Also the sudden pressure applied in Lota's writing suggests suddenly occurring temper, which again rather confirms the observations of those who have been closely associated with her.

Insufficient as the material is, it plainly indicates that the different environments in which these identical twins have lived has greatly influenced their personality, and that there is a considerable divergence in their self-expression as well as in their behavior. Leta has partly succeeded in overcoming her self-consciousness and timidity, and in controlling her moods as well as her ways of self-expres-

sion; whereas Lota's irritability has apparently only increased, and her temper grown less controllable, as the years passed.

[The authors prefer to reserve to a later date their major conclusions from the handwritings and drawings of identical twins reared apart. That is, until after they have presented further typical cases and analyzed the particular environments which have contributed to the shaping of the personality of the thirteen "reared apart" cases thus far traced.]

THE DELIMITATION OF INFLUENCES OF ENVIRONMENT AND HEREDITY ON MENTAL DISPOSITION

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Unexpected difficulties are met at once if we attempt to go beyond the trivial assertion that our mental properties are partly the result of heredity and partly of external influences, and if we seek to penetrate more deeply into the problem of the differentiation between the influence due to environment and the influence due to heredity in its effect upon personality. Many of the instincts which formerly played a part in the structure and formation of society lose their significance and purpose with the advance of culture. The primitive impulse towards revenge had to make way to a criminal code which substituted for it a penalty determined by the social significance of the crime; and modern demands tend progressively to eliminate the notion of penalty from the criminal code, its place being taken by the question whether the steps taken against the criminal are socially desirable. The personality of the criminal is taken into account. When this is done it is possible to decide whether he can be treated and cured or must be placed under supervision as incurable. Thus the instinct for revenge has become useless and harmful and has been replaced by a scientific method.

A part of the instincts which formerly controlled propagation is now passing through a similar process. The rapid increase of intelligent birth-control deprives the traditional moral and eugenic instincts and views of their significance. Propagation begins to be controlled by the deliberate will of the individual, who, in turn, is largely swayed by economic considerations. The economic welfare of the classes is no longer subjected to the free play of forces but to a large extent is determined by the care of the State. By the economic support of certain classes the State indirectly exerts a growing influence upon the number of children in the different classes; more

and more the State is enabled to determine the type of men of which the future race shall consist. Latterly State interference in national economy has been growing irresistibly, although hitherto little attention has been paid to the fact that the influence of the State upon eugenics thereby becomes enormous. Already, however, eugenic arguments are beginning to be introduced into the economic struggle. Thus the freshness and raciness of the peasantry, contrasted with the alleged degeneracy of certain elements of the urban population, is brought forward by the peasants as a weighty argument in their campaign for agrarian protection. Officials and teachers demand higher salaries and reduction of the cost of living on the ground that their children constitute the intellectual reserves of the nation. Immigration regulations permit the State to eliminate the hereditary influences of other races or alternatively to allow them to mingle with that of the nation. The treatment of the insane determines whether they can propagate or not. The measures taken by the State determine whether criminals can or cannot multiply, and, in short, most of the measures of the State have a far-reaching influence upon eugenics.

Accordingly the State might well take into consideration the results of the study of heredity. An appreciation of the influence of environment is, however, equally important; the entire education of the young and the practice of jurisprudence are largely dependent on it. If we develop these considerations further, we are led to the conviction that the development of our race and our culture is largely dependent on the state of our knowledge of the effects of heredity and environment upon personality. Nevertheless science has failed to provide sufficient facts to enable the State to act systematically; and all the measures taken for the formation of a future race are mere gropings in the dark.

From the purely scientific point of view, too, the study of these facts appears promising. I shall point merely to the fact that the question of the inheritance of acquired characteristics can be studied with much more hope of success if mental properties are dealt with than if physical properties are considered. Phylogenetically, the development of mental properties proceeds incomparably more rapidly than that of physical properties. Accordingly, if acquired characteristics due to the influence of environment are ever inherited, we may expect to be able to observe this process in mental rather than in

physical properties. Formerly, many generations of mice had their tails cut off and when it was observed that the later generations of mice continued to be born with tails it was considered safe to infer that acquired characteristics could not be inherited. Nowadays it is impossible to allow such experiments convincing force. It would be a different matter if it could be shown that inherited mental characteristics cannot be influenced by environment. In recent years our knowledge of the inheritance of acquired characteristics has not increased considerably; if psychological investigations succeed in discovering new facts in this field, biology might derive a considerable stimulus.

I have deliberately used rather grandiloquent language in order to point out the importance of the scientific investigations of the inheritance of mental characteristics. In passing over to some observations on the results of these studies, I am compelled to use less high-pitched and more modest words. It is particularly necessary to be on my guard against obscuring by phrases the contrast between what we ought to know and what in fact we know in this sphere; indeed it will be one of the main objects of this paper to emphasise this contrast.

The study of the inheritance of mental characteristics is considerably hampered by our ignorance of the meaning of "mental properties." We know that, genetically, many physical properties are inherited uniformly, depending upon a gene; but we have been unable to establish this in regard to any mental property. An inherited property can be due to one gene or to a definite group of genes. In this case we are enabled to test the validity of the Mendelian laws in the inheritance of this property. Now it is a prevalent view that, once it is known that a property is inherited, the manner of the inheritance must be determinable according to a definite Mendelian formula. This view, however, can be met by reference to another possibility, viz., that a property may depend upon an infinite number of genes, or that it may be the result of an incalculable interplay of heredity and environment, or finally, that it is the necessary concomitant of a given combination of genes relating to other properties. In the latter case it will be impossible to discover any of the Mendelian rules of inheritance; and accordingly it may be impossible to discover any of Mendel's laws in the inheritance of mental properties because it may be the case that all mental traits belong to the last

mentioned group of inherited properties. In any case we have no right to believe that we are bound to discover Mendelian rules in the inheritance of mental properties and that all results which fail to fit into the Mendelian scheme are scientifically valueless. Theoretically we must admit that all properties must be inherited according to Mendel because all processes of inheritance hitherto observed in detail took place according to Mendel. In my opinion, however, the essential point in practice is that in dealing with a large number of properties we cannot even attempt to discover the Mendelian laws because the facts are far too complicated. In practice we have to take into consideration the possibility that by the side of properties in which the Mendelian mechanism is recognisable, there are others where this is not the case.

Which mental properties are most likely to correspond to genetic properties, so that we can study heredity in them, making use of Mendelian principles? An attempt may be made to look for suggestions to answer this question in the field of the inheritance of physical properties. In doing so we discover two facts:

1. The physical properties which are pure from the point of view of heredity were discovered entirely empirically and not deductively. We are never able to say *a priori* whether a physical property is pure from the point of view of heredity, i.e., whether it is or is not inherited in accordance with a simple Mendelian scheme. Frequently apparently simple properties independent of environment do not conform to Mendelism whereas apparently complicated properties display quite a simple Mendelism. For example, the length of rabbits' ears is inherited; but in this process none of Mendel's laws can be discovered (W. E. Castle, H. E. Walter, R. C. Mullenix, and S. Cobb). On the other hand the length of hair in rabbits is inherited on the simplest Mendelian lines, short hair being dominant over long hair. Huntington's chorea, a nervous disease with numerous clinical and anatomical signs, is inherited as a simple dominant trait, whereas it is impossible to discover any Mendelian rules for many other nervous diseases which can be inherited.

2. Mendelian properties are invariably characteristics which can be changed apart from the rest of the body. Properties whose change necessarily involves changes of other organs do not behave along Mendelian lines. Similarly we are more likely to define Mendelism in properties which are caused by one single anatomical

change, than in properties which arise through the interplay of a number of physical properties. Myopia for example arises through a *relative* increase in the refractory power of the various media of the eye *relatively* to the length of the eyeball. Despite comprehensive investigations on the subject of their hereditability, it has proved impossible to show that they are inherited in accordance with any given Mendelian mechanism. On the other hand other changes of the eye such as nocturnal blindness and colour blindness can be explained by simpler anatomical relations and are inherited in accordance with the simplest rules of Mendelism. The colour of a fur, of a blossom, or of a spot on the wing of a butterfly, the blood-grouping of any individual, the number of spirals in a snail's shell, and innumerable other properties which follow a simple Mendelian scheme are largely independent of the structure of the rest of the organism.

A considerable part of early investigations on the heredity of mental properties refers to comprehensive complexes of properties which are merely intellectual abstractions. The most considerable attempt to trace back inheritance of characterological types to Mendelian rules is probably that of Kahn in his theory of the inheritance of the schizoid and of schizophrenia. Kahn assumes that the schizoid is inherited as a simple dominant property. This hypothesis did not meet with general approval; and indeed it conflicts with observed facts which show for instance that two non-schizoid parents can produce schizoids, which is incompatible with the assumption of a simple dominant process of heredity. In an earlier essay I have given a more detailed description of an example of schizoid children with syntonous parents.[1]

A large mass of facts has been collected showing that the various psychological types are at least partially affected by heredity. At the same time we have no knowledge whatever of the manner in which they are inherited, and we have to acknowledge that they appear to be inherited directly as well as indirectly, that some observations seem to attribute a large and others a small part to heredity, and, in short, that instead of a number of clear rules of heredity we are faced with so many riddles. It is true that we are no better off with the physical types. The manner in which the pyknic constitution is inherited is as obscure as that in which a syntonous character is inherited. The several types are an attempt to comprehend from

[1] Zeitschr. f.d. ges. Neurologie u. Psychiatrie, Bd. 127, page 321; also *The Journal of Nervous and Mental Disease,* Vol. 74.

one single point of view a maximum number of properties; and we have already pointed out that such bundles of properties generally cannot be shown to be inherited on Mendelian lines: the Mendelian rules are found to operate in properties of the simplest possible structure.

Further, separate studies have been devoted to the inheritance of intelligence. It has been discovered that intelligence is largely dependent upon family factors, although we can hardly expect that it will be possible to analyse intelligence into a number of pure genetic properties, for the inheritance of which definite formulae could be found. The fact is that intelligence is a concept reached by psychological abstraction. From the point of view of genetics, it may not be possible to distinguish between the intellectual and the emotional sphere: what is inherited is always the readiness for a reaction. A mental readiness for reaction, however, never consists of a purely intellectual or a purely emotional readiness for reaction. Every intellectual effort must be based upon some interest or emotion. But every emotion, even when we are dealing with a primitive instinct, has a content which presupposes some intellectual process, and although it is convenient in psychological terminology to distinguish between intellectual and emotional events, there is not the least reason for assuming that they are also inherited separately. On the contrary, the fact that intellectual and emotional readiness for reaction are always found coöperating and never occur in isolation, makes it appear probable that, from the genetic point of view, a series of intellectual properties cannot be distinguished from a series of emotional properties. A desire to operate with properties as clean-cut as possible has led investigators to distinguish as widely as they can between emotional and intellectual processes and to operate either with purely intellectual or with purely emotional characteristics (e.g. the investigations on the inheritance of schizoid and cycloid, on school performances, on moral dispositions, etc.). There would appear to be some justification for taking the opposite course and for starting from the (equally not established) assumption that genetics differs from theoretical psychology in that it does not admit any separation between intellectual and emotional properties. In that case in investigating mental inheritance we must try to look at the psychical reaction to a given stimulus as a whole.

It has also been found that the interplay of factors due to

heredity and environment is of such a complicated nature that in regard to the psychological types and the more generalised mental traits a complete diversity of opinion exists in spite of comprehensive investigations. Thus family resemblances of the intelligence quotient are attributed by one author to environment, and by another to heredity. It has been definitely determined by such exhaustive works as those of Hoffman, Kahn, and others that family influences play an essential part in determining psychological types: but even here there is no exact information to show whether these family influences are due to heredity or to environment. At the same time numerous observations indicate that in the formation of characterological types, environment plays an important part. In this connection I may mention Ziermer's investigations on the social behaviour of the families of a certain village through a number of centuries (Archiv f. Rassenbiologie, 5, 1908). Ziermer found that the same families generally maintained a definite tradition in relation to personal initiative, sociability, progressiveness, tendency towards anti-social actions, politics, etc. Hardly any influence was exerted on the social type of the family by the women who constantly entered it by marriage. This would seem to indicate that environment, as manifested in family traditions and external conditions of life, is of considerable importance in the formation of character.

Facts drawn from the somatic theory of heredity, the necessary interconnection between intellect and emotion, and the vagueness or contradictoriness in the application of observations hitherto made on the inheritance of mental traits suggest that it may be worth while to investigate various mental properties other than the leading psychological types and the groups of properties established by psychology. The investigation of these minor properties would deal with the hereditary and environmental factors out of which they arise. In this respect small and apparently insignificant traits are especially well worth observation. The fact that heredity plays so important a part was itself discovered only from the fact that unimportant properties apparently not influenced by external factors occur within different families. To take only a few examples, there are such family peculiarities as the inclination of the head in asking a question, hiding the hands anxiously, a peculiar casting up of the eyes when meeting others, peculiarities in the pronunciation of

foreign languages, the manner of reaction to alcohol, and hypersensitiveness towards certain smells and noises. Friedmann has also drawn my attention to the element of heredity in the way in which babies use their hands to grip, a phenomenon which I have since been able to observe on several occasions. It is interesting to note that the conclusion that minute mental properties are characteristic for personality and well worth study, can be arrived at in quite different ways from ours. Thus Friedländer remarks in the first issue of this Quarterly that art experts answer the question whether two works are by the same artist from certain external characteristics such as flourishes, idiosyncrasies, and secret and involuntary signatures, and that the experts are unable to rely upon the more general characteristics which are usually taken to be the expression of the artist's character. Friedländer observes in this connection: "It looks as though a man could change his philosophy, and disposition, but not the way in which he holds a spoon." With monozygotic twins the identity of mental peculiarities can be demonstrated with particular ease in the small reactions. Thus Loewenstein (Report on the fourth Heilpädagogik Congress) discovered that the form in which the reaction to light in the pupils is affected by mental stimuli was largely identical in monoval twins, and this not only qualitatively but also quantitatively. These and other numerous "psychical details" allow us to study with some hope of success the influence of environment and heredity on the mind.

In order to take one example showing how clear formulations of problems can be reached when dealing with psychological details I shall confine myself to a discussion of attempts made in connection with Rorschach's experiment in form interpretation. These experiments were undertaken on the lines of the questions outlined above. Part of them were published in greater detail in 1929 in the *Zeitschrift für die gesamte Neurologie und Psychiatrie* (Vol. 118).

Rorschach's experiment[2] consists in placing before the subject ten plates, partly coloured, showing irregular figures produced by splashing the paper with ink and then folding it. The subject is then asked to say what each figure might mean. In interpreting the experiment the first thing is to see whether the answers relate to the whole figure, to one well-defined part of it, or finally to a small part arbitrarily separated from the rest and not forming part of the whole

[2] A detailed account of these experiments is to be found in Rorschach, *Psychodiagnostik*, published by Bircher.

shape; and they are classified accordingly into answers relating to the whole, the part, or to a small part. In the interpretation the shape alone may determine the answer, or again it may be the colour which determines it (e.g. when a red splash reminds the subject of blood); shape and colour may also be at work simultaneously. Besides answers embodying shape and colours there is a third group which embodies movement. By this Rorschach does not mean a reply which simply expresses movement by itself; what he has in mind is an interpretation in which the subject of the experiment partially identifies himself with the figure he is interpreting, and in which he shares its attitude. When a figure is interpreted as an aeroplane in the air, such reply is not an example of this type of interpretation but "a man huddled in an attitude of dejection" is considered to be a kinaesthetic answer. Rorschach further distinguishes between apt and inept interpretations, a distinction which requires a considerable experience before it can be made. The percentage of apt interpretations is here the essential matter. Answers are further classified according to their content; the percentage of interpretations involving animals is remarked especially. Finally a note is made of the number of replies which are found with particular frequency or with particular rarity in other persons undergoing Rorschach's experiments. These replies are classified as commonplace and as original respectively.

Rorschach has demonstrated that the factors enumerated allow far-going conclusions to be reached about the personality of the subject of the experiment. The conclusions cover his emotional side as well as the kind and measure of his intelligence; in other words the reactions to this test, like all mental reactions, consist of intellectual as well as of emotional qualities. Now I was able to demonstrate that the records relating to two brothers or sisters showed much more similarity than those of two unrelated persons both in regard to the number of replies relating to whole, part, or small part, and in regard to the frequency in which colours were taken into consideration and in which kinaesthetic identification took place, as also in respect to the percentage of apt replies and of partial replies and to the number of original and of commonplace replies. The distinction was plain and was observable in all the factors. O. V. Verschuer[1] compared the same factors in the records of mono- and dyzygotic

[1] *Vererbung und Erziehung*, Berlin, 1930.

twins, and came to the conclusion that their similarity is greater with monozygotic than with dyzygotic twins.

Now my records of the Rorschach experiment as applied to brothers or sisters showed me answers which were generally of very rare occurrence but which were repeated by brothers or sisters. There were even occasions where a number of brothers or sisters interpreted some small detail of the inked figure in an identical manner, while the same interpretation was never again met with in the course of hundreds of experiments. I concluded that Rorschach's factors (the number of answers relating to the whole, to movement, form, or colour, etc.) must be due to family influences and further that this must be true also of the tendency to give the same reply for the same splash. This discovery was so surprising that I assumed that I must be mistaken and proceeded to test it statistically. This I did in a number of ways; part of my calculations is given in detail in the work previously mentioned. It is sufficient to observe here that the numbers were sufficiently great and the differences sufficiently unequivocal to admit the assertion that similar answers are commoner with brothers and sisters than with children of different parents, and that this difference is no mere accident but is actually the result of family influences. Thus in a series of forty-one Rorschach records I have counted the answers which were given twice and twice only. An easy calculation shows that the forty-one records admit of 820 combinations of two records each. Of these, forty-seven combinations consisted of the records relating to two brothers or sisters. Thus the total number of combinations is to the number of combinations as between brothers or sisters as $820 : 47 = 17 : 1$. Thus if everything had been controlled by chance we might have expected that for every answer given twice and twice only by brothers or sisters, seventeen answers would be given twice and twice only by others than brothers or sisters. In fact, however, instead of seventeen similar answers by non-brothers or sisters being found for every one answer by brothers or sisters the relation was 4.5 to one.[4] We find accordingly that similar answers are four times as frequent with brothers or sisters than with non-brothers or sisters.

Now it had to be determined whether the similar answers given by brothers or sisters were comparatively frequent by accident

[4] The actual figures are: of the fifty-three answers which have been given twice and twice only ten are by brothers or sisters and forty-three by non-brothers or sisters.

or whether any law could be discovered governing them. If there were no law, the fifty-three similar answers would be distributed in the proportion of 47:773 among the brother-sister and non-brother-sister combinations. Of the fifty-three answers, three answers would thus be due to brother-sister combinations ($\frac{47 \times 53}{820} = 3$); the mean error here amounts to $\sqrt{\frac{50 \times 3}{53}} = 1.7$. Thus the mean divergence from the maximum probability amounts to 1.7 whereas the observed divergence is 8.3, which is five times as much as the theoretical amount. Accordingly the number of similar answers given by brothers or sisters cannot be attributed to chance; they must be due to family influence.

A number of countings consistently gave the same result; I therefore consider it as proved that Rorschach's experiment gives remarkably similar results for brothers or sisters, that this similarity does not confine itself to the various factors calculated by Rorschach and to a number of details in the manner of interpretation, but that further we find more frequently equal replies with brothers and sisters than with non-brothers and sisters. It would be wrong to assume that the interpretation of a blob of ink is determined only by accidental influences of the moment although it would be easy to make this assumption; the interpretation of a form is controlled by family influences to such an extent that it is reflected in statistics. We saw that the study of abstract groups of properties met with difficulties which had not yet been overcome, and hence it seems all the more significant that family influences can be traced down into the least of the mental reactions; for the consideration of such reactions provides us with a new method of studying family influences upon the mind.

The existence of family similarities in Rorschach's experiment having thus been demonstrated, a new question arises, viz., whether this similarity is due to heredity or environment.

It must be stated immediately that the answer to this second question must be formulated much more cautiously than the answer to the first. I have adopted a number of different methods to distinguish between the influence of heredity and of environment. One method consisted in dividing the subjects of my experiments into groups each of which had had a similar environment (e.g. urban

intellectuals, simple country people, Swiss and Northern German school-children), and in asking whether resemblance between brothers and sisters could be demonstrated to exist within the different groups. This was the case, a fact which suggests that family similarity is at any rate not due to the kind of environmental influence such as is the result of urban or rustic surroundings or of Swiss or North German education. The similarity must be due either to more subtle differences in environment, or else to heredity.

Another method was to undertake investigations in orphanages, where it was found that here too brothers or sisters gave results showing a much greater similarity than those of unrelated inmates. In orphanages the differences between brothers and sisters and non-brothers and sisters are due chiefly to heredity causes since the environment is the same for all. This clearly indicates the great part played by heredity in causing the similarity between the Rorschach results of brothers and sisters.

Thirdly, I attempted to test brothers or sisters who had grown up in different environments and to discover if any similarity could still be found. Unfortunately my experiments in this direction were not sufficiently numerous. Here I will confine myself to one observation which seems to me to be of particular importance. A child was adopted by a well-to-do merchant's family, while the sister remained with the parents in very poor circumstances. The two sisters did not know each other and had never met. The adopted child was educated in superior schools, while the other had early to earn a living and to support her parents. The adopting parents lived in harmony, while the true parents were continually quarrelling. Now the records of these two sisters show a striking similarity, not only in the individual calculated factors, but also in a great many individual answers. It was really remarkable to find that when confronted with a blob of ink both picked on one insignificant detail which had never been selected by any other of the persons on whom I experimented, and that they gave the same interpretation of this figure, one which did not occur in hundreds of other records. Here the peculiarity of the answer is so great that it is impossible to explain the similarity by chance. It cannot be due to environment, and thus we seem to be forced to the conclusion that the identical reaction to the blot of ink is due to heredity.

The result of our studies was to lead us to the conclusion that the

similarities between brothers and sisters as shown in the Rorschach records are mainly due to heredity. Although we still remain ignorant as to whether and to what extent heredity influences the groups of qualities selected for purposes of study, we have good reasons to believe that its influence can be traced to the smallest reactions.

It goes without saying that Rorschach's method does not afford a royal road for the study of the interaction of environment and heredity in forming the mind, and that there are numerous other methods for studying this question. This kind of investigation must be on a small scale and can at best contribute isolated stones to the edifice of the theory of heredity.

It would be a sin of omission not to mention one line of research which contributes largely in throwing light on these questions, viz., the study of twins. A comparison between the mental properties of monoval twins (i.e., twins genetically identical) constitutes one of the most important methods for distinguishing the influence of heredity from that of environment. It is possible even to express numerically the hereditary and the environmental factor, as has been done by O. von Verschuer. The difference between bioval twins may be due to the influence of environment or to hereditary disposition, whereas that between monoval twins must be the effect of environment. If we assume that the difference due to environment in the bioval twins is equal to its effect in monoval twins, the factor due to environment can be reached by dividing the average difference of monoval twins by that of bioval twins.

Far-reaching conclusions on the method of distinguishing between the hereditary and the environmental factor have been drawn from the study of twins, and it must be remembered that these assume that the difference due to environment is equally great with bioval twins as with monoval twins; and indeed O. von Verschuer has expressly drawn attention to this point. This assumption, however, does not agree with the natural facts; for environment and hereditary disposition, far from acting upon the individual independently, stand in a relation of reciprocal causality. To a certain extent man creates for himself the environment which acts upon him. Thus identical twins are more likely to have similar social interests than twins genetically dissimilar. The result is that they create for themselves an environment which is more uniform than that acting

upon bioval twins. Thus twins genetically alike differ from those genetically dissimilar not only in the total mass of their heritage; they are also exposed to more similar environmental influences than twins genetically dissimilar.

The material collected by Lange goes to show that monoval twins have tendencies to similar crimes much more frequently than bioval twins. It would, however, be wrong to draw the obvious conclusion that the criminal tendencies were inherited. On the contrary, the possibility must be taken into account that identical inherited properties created an identical environment which in its turn produced the criminal. For example, two monoval twins might, as a result of heredity, display an intellectual incapacity for carrying on a complicated business inherited from their father. The result might be that they have to emigrate and become impoverished; and it is a common view that poverty leads to crimes against property. It would in this instance be a mistake to infer from this tendency to crime in the monoval twins that the tendency towards crimes against property was an inherited quality; and it would be equally erroneous to conclude that poverty as an environmental factor did not play a part in making criminals. In our example the only inherited quality would be the lack of certain business capacities while the criminal disposition would to a large extent be due to environment; and yet we observe similar behavior in both the monoval twins.

Similar environments may also be the result of purely physical characteristics. If one of two monoval twins has a more prepossessing face than the other, they will meet with very different treatment from their parents, brothers, sisters, teachers, comrades, and from members of the other sex, and possibly the behaviour of others towards a person is an environmental factor exerting a decisive influence upon his personality.

If I should draw attention to the fact that conclusions drawn from the study of twins must be utilised with care, I do not intend to reflect on the value of this study, which is of fundamental importance for our problem. I did so simply in order to justify the pursuit of other methods and their detailed discussion by the side of the study of twins. This study cannot save us the labour of investigating the mental reaction of persons having a similar heredity when exposed to different environmental influences, as well as the mental reaction of persons having a different heredity when exposed to similar environmental influences.

From the standpoint of the study of heredity we have to welcome the publication of a periodical for psycho-diagnostic studies, like this Quarterly. Among the contributors the most diverse views upon the question of the influence of heredity and environment upon personality are to be found. It is precisely the diversity of opinions which will indicate how little well-grounded knowledge and how much instinctive assumption still exists in this sphere. Such a periodical will thus compel us to scrutinise our opinions more critically and to formulate fresh questions when approaching our material; and it will also enable us to collect material for observation from a large variety of numerous fields of mental experience and to digest it with reference to the existing questions; whereas hitherto studies have tended to confine themselves too much to a restricted number of complexes of mental properties.

Recapitulation: A study of small and apparently unimportant mental peculiarities and reactions can be utilised with hopes of success for the study of the influence of heredity and environment, if only from theoretical reasons. Such studies need not confine themselves exclusively to twins. The interpretation of accidental ink-blots according to Rorschach shows how family and hereditary influences can be traced down into the most minute reactions.

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THE PERSONAL TEMPO AND ITS INHERITANCE

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While the important subject of the inheritance of psychic characters has long attracted the attention of inquiries into the laws of heredity, it is only during the last few years that any attempts have been made to investigate the laws of inheritance of *normal* intellectual and psychic characters. One of the reasons why this subject was so long neglected is assuredly the fact that the psychic characters, as they make their appearance in living, thinking, active human beings, are in most cases compounded of quite a number of component characters, which are intimately intermingled and interwoven to form a whole; and these component characters in turn depend on a whole series of secondary characters, or on various dispositions, which may be, and actually are, independently inherited. If we wish to ascertain the relations of disposition and environment and the transmission by inheritance of psychic characters, we must not investigate the complex structures—for the diverse inheritance of even a single component character may so modify the character-complex that it can no longer be recognized. We must try, so to speak, to begin at the bottom, to seize upon the elementary characters and functions, and seek to ascertain the workings of heredity in respect to these. In exhaustive investigations of twins and families I have endeavored to trace the biological laws of the inheritance of one such elementary psychic character, namely, the personal tempo.

With William Stern, we understand by tempo the time or pace corresponding to a series of musical tones—that is, the time which will express the inner content of a melody to the best aesthetic advantage. This involves the fact that the tempo is not merely an objective melodic tempo, but is at the same time a subjective tempo of perception. This, however, applies not only to musical impressions, but to every psychic transaction unfolding itself in time. As apprehending individuals we know precisely—or at all events in most

cases—whether we feel the speed of any happening to which we are paying attention—for example, of a speech—to be suitable, natural, sympathetic. And, in the same way, when we actively intervene in any happening, when we speak, or walk, or perform any deliberately willed action, we choose, quite spontaneously, a congenial tempo for the transaction in question—a tempo which is natural to us. It is true that every action has a suitable tempo of its own—corresponding to the objective musical tempo—which I might call the individual tempo of the action; but in addition to this there is an individual tempo of the personality, the *personal* tempo, which is expressed more or less markedly in all our doings, in our acts of perception and our volitional processes. The personal tempo adheres to the individuality as a whole; the integral psyche, as a unity, abhors one tempo as unsympathetic to it, or recognizes another as sympathetic. Now if every individual has his own characteristic tempo, the question at once arises, whether, in the case of definite groups of individuals, there is a tempo characteristic of the group as it exists at any moment. Is the tempo of certain periods of life, for example, of youth, characteristically different from that of maturity? Are there differences of the average tempo in the two sexes? Does the social environment influence the tempo? Not only have the answers to all these questions an interest and a value of their own, but the information thus obtained is important and even necessary for the solution of the problems of biological inheritance. For the questions which especially interest the investigation of the problems of heredity branch off into two directions: first, there is the question whether, and how far, the tempo is conditioned by heredity; and second, the question whether, if it is so conditioned, it is possible to discover a definite mode of inheritance?

The determination of the personal tempo was effected by various experiments which I may briefly describe as tapping and metronome experiments. The tapping experiments were subdivided into three subsidiary experiments: tapping against or upon the table with a spontaneously chosen position of the hand or fingers; tapping on the floor with the foot; tapping the edge of the table with the outstretched forefinger. In all these experiments the subject of experiment (as a rule, of course, only single experiments were made) was asked to tap the floor or table in the tempo most agreeable to him

or her; and this direction was always especially emphasized. The number of taps given in a period of ten seconds was recorded. In the metronome experiment the subject was given several tempi, one after the other. He had to say, in the case of each tempo, whether it was too slow, too quick, or precisely agreeable. Since in most cases several of these various tempi were said to be agreeable, two of the tempi so described were given in succession, and the subject had then to say which was the more agreeable of the two. Thus, by gradual elimination, the tempo most agreeable to the subject was determined. This kind of experiment was performed with all the subjects, who were persons of all ages.

Next, it had to be determined whether the tempo of the individual exhibited a definite constancy, or whether it was not affected by any sort of environmental influences. [Such experiments had already been made by other workers: Van der Horst (1924), Levitan (1926), Fritz Braun (1927), Ernst Lau (1928).] The test for the intra-individual constancy of the personal tempo was made as follows: the same persons (members of the Kaiser Wilhelm-Institute) were subjected to the same experiment at the most dissimilar times; in fact, each of the tapping experiments described above was repeated on four different days, in most cases with an interval of one or two days between the second and third experiments. The group of the four metronome experiments was made twice over: the intervening period of two months corresponded with the summer vacation. The experiments were made at all different times of the day. This had the advantage that the subjects were tested in different moods, or in different stages of freshness or fatigue. The weather, which in many persons influences the psychic bearing, differed also at the time of different experiments, varying from the sultry summer heat of "thunder weather" to clear, sunny days of autumn. Thus, the summer holidays that separated the two groups of metronome experiments might very well have produced a different psychic and physical bearing in the various subjects.

From the results of the four individual experiments of each group the mean value, M, was calculated for each person, and then, with the aid of the absolute deviation, e, the percentage deviation from this mean value, or index of variability, v, was determined.[1]

[1] Example: tapping with the outstretched forefinger: Expt. 1: 23 taps in 10 sec. Expt. 2: 22 taps. Expt. 3: 26 taps. Expt. 4: 24 taps. $M = 23.75$, $e = 1.25$, $v = 5.26$.

From the sum of the individual indices of variability the mean index of variability for all the subjects was calculated: This was, for

Tapping with spontaneously chosen attitude of hand or finger	4.45
Tapping with the foot on the floor	4.54
Tapping with outstretched finger on the edge of table	4.45
Metronome Experiment 1	3.76
Metronome Experiment 2	2.64

The intra-individual variability of the tempo in each group of experiments is thus extremely small, and smaller in the metronome experiments than in the tapping experiments.

While the three groups of tapping experiments show slight differences among themselves, yet they also reveal a certain similarity. In the same way, the two groups of metronome experiments, which were divided by a period of two months, show a certain difference; in any case they are not so similar as the experiments made on four closely adjacent days. I have calculated how far the tempo varied in each subject of these experiments, by comparing in each case the mean values of the various groups of tapping experiments and the mean values of the two groups of metronome experiments. In the tapping experiments the mean index of variability for all subjects was 6.1, and in the metronome experiments 3.63. Thus, despite the greater interval of time between the two metronome experiments, no alteration of the personal tempo occurred; and even the groups of tapping experiments, which do show some difference among themselves, reveal only a very slightly enhanced variability of tempo.

Further, on calculating the relation of the tempo determined by the tapping experiments to that determined by the metronome experiments, the mean index of variability was found in this case to be 12.41. It will be seen that the greater the difference between the experiments, the greater is the average variability (which is, of course, absolutely, very small in any case) of the personal tempo. On the other hand, a greater or smaller temporal interval between the experiments has an inconsiderable influence on the variability of the tempo.

The results of these repeated experiments with the same persons prove how great is the intra-individual constancy of the personal tempo, and how little it is altered by various environmental differences. I have tested this point still further by determining the tempo under artificially modified and conspicuously different environmental

influences. The result was the same: a marked intra-individual constancy of the personal tempo.

In addition to the question of the intra-individual constancy or variability of the tempo there was yet another question to be investigated, namely, the degree of variability of the personal tempo in a population. Some one thousand individuals were tested, of all ages, from eight to eighty and over, and of both sexes, and these persons were drawn from the most varied social environments. The social milieu (which was taken into account only in the case of schoolchildren from the upper and public schools) had no influence on the tempi registered; the extreme tempi, on the slow side and on the fast, the distribution of the various classes of variants, and the mean value of the tempi, were the same in the different social strata. The inter-individual index of variability was likewise the same in both social groups. The residual material could therefore be classified only according to sex and age, a class being formed, in the case of young people, for every two years of age, and in the case of subjects over twenty for every ten years of age. In both sexes, and at all ages, we find approximately the same extremes of tempi in either direction; even the distribution into the individual classes of variants (a class for every five taps) is approximately the same. The number of taps made in ten seconds varied from seven to fifty-eight, showing how many different tempi were registered among the persons tested. Even in the metronome experiment the number of tempi found agreeable by one subject or another was spread over the whole range of the metronome (that is, from forty to two hundred and eight per minute). It is characteristic—and this was observed in approximately all the persons tested—that in the tapping experiment fewer individuals fell into the slow class of variants than in the metronome test: that is, in the metronome experiments a *rather* slower tempo was, on the whole, sympathetic. The average mean value of the tapping tempi, for all the male subjects, was 23.06; for the female subjects, 23.78; for the metronome tempi, male subjects, 18.7, female 19.6 (strokes in ten seconds). The female subjects are apparently rather quicker in tempo; this fact I was able to establish also by other kinds of experiments, but the variations have not been statistically determined, and I should not like as yet to draw any conclusions therefrom. Neither were the variations at different ages statistically determined.

The answer to the question, whether any marked deviations from this mean value occur, is of great importance to the biology of inheritance. The inter-individual index of variability in the tapping-tempo is approximately 30; in the combined tapping and metronome tempi, about 27. If we compare these figures with the intra-individual indices of variability we shall see at once a great difference; together with intra-individual constancy we find a marked inter-individual difference of the personal tempo.

On the basis of these results we can proceed to deal with the problems of biological inheritance, and first of all with the problem of the hereditary determination of the personal tempo. One hundred and eighteen pairs of twins were tested, fifty-three of whom were monozygotic twins (MT), forty-nine dizygotic twins of the same sex (DT), and sixteen dizygotic twins of opposite sexes, or "paired" brothers and sisters (PT). The results, which were at first calculated separately, might have been reckoned in common for both sexes and all ages, since the previous experiments had shown that reliable differences of tempo for different sexes and different ages do not occur.

If a complete constancy of tempo in the same person can be shown only in individual cases, and if we have always to reckon with a certain intra-individual variability—though this keeps in mind any narrow limit—we should naturally have all the less justification for expecting that pairs of twins, even if of monozygotic inheritance, would possess an absolutely equal tempo. The question is, whether the tempi of monozygotic twins are on the average more similar than those of dizygotic twins? In Figure 1 the abscissae give the amount of the percentage deviation, and the ordinates show what percentage of the pairs of twins tested fall into the variant-classes in question. The difference between MT and DT is plainly apparent, especially in the deviations under five per cent; about 44 per cent of the MT fall into this class, as against only twenty-three per cent of the DT. While in the MT there is a steep falling-off until the variant-class twenty-five is reached, the slope of the DT is much flatter, and runs quite gradually into the classes forty-six. Merely from the distribution of the different variant-classes it becomes apparent that MT are much more alike in their tempi than DT. But this means that pheno-typically also the inherited disposition is clearly manifested in the personal tempo. The validity of this assertion can be

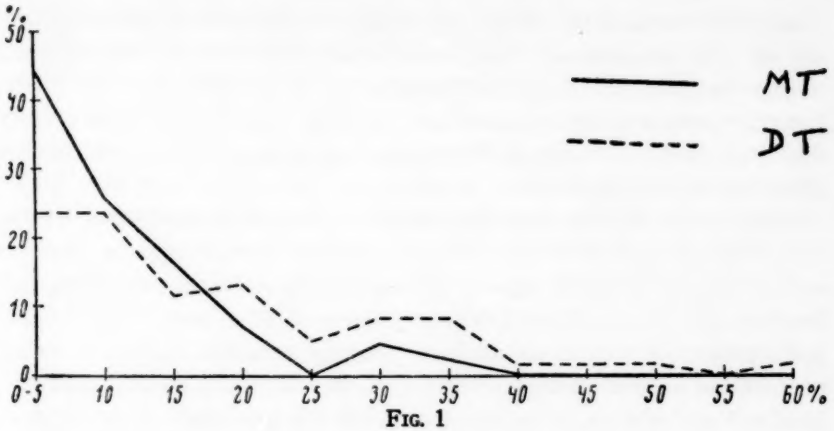

FIG. 1

tested in a second manner, by calculating the mean value of the percentage deviations for all the twins of one category. For the tempi determined by tapping this is, in MT, 11.1; in DT, 17.5; for the tempi determined by metronome, in MT, 7.8; in DT, 15.5; for the combined tapping and metronome tempi, in MT, 7.8; in DT, 15. Thus, in all experiments it is much lower in MT than in DT.

What conclusions are we to draw from these results? The peristatic influences (in the widest sense of the word, including errors of measurement) certainly play an important part in the manifestation of the personal tempo, as also in the possibility of its determination by appropriate experiments. If this were not so it would be impossible to understand why the intra-individual variability of tempo which we had already established—small indeed, but always present—should have appeared. Such variability as may safely be ascribed to errors of measurement and environmental influences would affect MT and DT in an approximately equal degree. If the DT show such very much greater percentage deviations of tempo than the MT, we must ascribe the difference to the fact that the stimuli of environmental influences act upon different inherited dispositions in the DT, but on similar inherited dispositions in the MT, and consequently, that in the DT a greater difference of manifestation occurs than in the MT. The dissimilar manifestation of the personal tempo in the different classes of twins is a convincing proof that the personal tempo is not merely conditioned by external influences—education, habits, environmental conditions in the widest sense, etc.—but depends in a great degree upon inherited disposition.

From the comparison of the percentage deviations of MT and DT we are able to estimate that in the manifestations of the personal tempo the inherited disposition counts for about fifty per cent. This figure, which is to be regarded as the minimum share of hereditary determination, has already been obtained in respect to physical and other psychic characters.

And now another question arises: what is the relation of the variability of tempo in twins to the variability of tempo in brothers and sisters of different ages? Theoretically speaking, the tempi of brothers and sisters should not vary more widely than those of dizygotic twins. For age, as we have already established, has no influence on the absolute tempo of individuals. If, then, we compare two brothers and sisters, it is indifferent for the purposes of our experiment by how many years they differ in age.

Before stating my results I should like to go one step further in the analysis of variability, and compare the variability of tempo occurring in twins with the variability observed in a population. Figure 2 compares the variability occurring in twins with that of

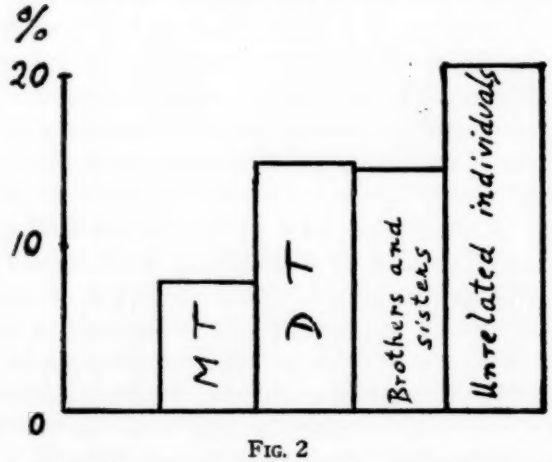

FIG. 2

ordinary sibs and that observed in unrelated individuals. Our theoretical expectation in respect to brothers and sisters is fully confirmed: the variability of tempo of DT, 15.5, corresponds almost exactly with that of brothers and sisters, 15.4. On the other hand, the percentage deviation of unrelated individuals, 20.6, is not only notably higher than in MT, 7.8, but is also considerably higher than in DT and brothers and sisters. If we regard the difference of tempo

in two monozygotic twins as determined only by errors of measurement and environmental influences, then these influences, which affect the MT, must also be assumed for the unrelated individuals of a population. In the light of the results already given I do not believe that we need take into consideration, as determining the different nature of the tempi in unrelated individuals, different kinds of environmental influences, as capable of causing considerable variations of tempo; for it was not possible to establish mathematically and incontestably any differences of tempo which might be determined by difference of sex, age, and social milieu. If, then, with approximately similar environmental influences, the percentage deviations of unrelated individuals are roughly 2½ times as great as those of MT, we must refer these greater differences to the very much greater differences of inheritance in unrelated individuals. The ascending scale of percentage deviations, from MT—DT and brothers and sisters—to unrelated individuals, is a sure and convincing proof of the extreme dependence of the manifestation of the personal tempo on the inherited disposition. The problem of hereditary determination is thus answered, in a positive sense, by research into the similarity of twins, and by the comparison of twins with brothers and sisters and unrelated individuals.

The question that now arises is whether we can discover a definite mode of inheritance for the inherited disposition of the personal tempo. By the methodical investigation of families—that is, by comparing the tempo of parents and children—an attempt was made to approach the solution of this problem. For example, what is the tempo of the children when both parents are quick or both slow, or—a case which unfortunately very seldom occurs—when one parent is extremely quick and the other extremely slow? In all eighty-five pairs of parents were tested, together with 318 children. In evaluating the results obtained there were two possible bases of comparison between parents and children. By the first of these possible methods we took as a basis the mean value of the tempo which we had determined for the population. The tempo lying at a certain distance—namely, the simple mean deviation *e*—on either side of the mean value we called the moderate tempo; on the one side of this was the quick tempo, and on the other the slow tempo. If we now combine the individual tempi of the couples of parents, we obtain six different combinations of parents: quick and quick, quick and moderate, quick

and slow, moderate and moderate, moderate and slow, slow and slow. We ascertained how the children of the six different combinations of parents were distributed over the three groups of tempi: quick, moderate, and slow. The number of children in the quick tempo group decreases in proportion to the slowness of one or both parents, and similarly the number of children in the slow tempo group increases in proportion to the slowness of one or both parents. For example, if both parents are quick, then fifty-six per cent of the children are quick, four per cent slow, and the rest moderate. If both parents are slow, then seventy-one per cent of the children are slow, and no per cent quick. If both parents have a moderate tempo, then about sixty-six per cent of the children are moderate, and seventeen per cent quick or slow respectively. There is thus a striking agreement between parents and children; the distribution of the children in the various tempo-groups depends very closely upon the tempo-group of the parent or parents. If we had only the results of our experiments with families to go upon, we might conclude that the education and environment of the children alone evoke a tempo similar to that of the parents. By our investigation of twins, however, we have established the hereditary determination of the personal tempo, and we are now justified in saying that the inherited factors, whose combination with the existing environmental stimuli affecting one or both parents results in a definite personal tempo on one side or the other of the mean, work in the same direction in the children.

It is true that the division into definite tempo-groups according to the absolute values of the tempi has certain disadvantages. Two related individuals, who closely approach the delimiting mean value, but on opposite sides, are classed in different groups, although their tempi may be very similar. This source of error is eliminated by the second possible method of comparison between parents and children. According to the percentage deviation of the parents from the mean value common to both, they were divided into concordant, moderately concordant, moderately discordant, discordant, and markedly discordant parents. Those parents who showed a deviation of eight per cent or less (which is the average deviation of monozygotic twins) were concordant; the next class showed a deviation of eight per cent to sixteen per cent, and so forth. It was then calculated how great was the deviation (taking the different couples of parents) of each child from the parent nearer to him in tempo. The children

were accordingly divided into six different groups; and it was found that: (1) 12.9 per cent of the children resembled both parents; (2) 24.8 per cent resembled the slower parent; (3) 25.1 per cent resembled the quicker parent; (4) 12.5 per cent were slower than the slower parent; (5) 18 per cent were quicker than the quicker parent; (6) 6.8 per cent came between the two parents. Thus about 63 per cent of the children resembled both parents in tempo when the latter were concordant, or one of them when they were discordant. From this method of calculation and estimation also we deduce the same result, namely, that the tempo of the children is very closely dependent on the tempo of the parents: that is, it is strictly conditioned by inherited disposition.

On the strength of the results of these experiments with families an attempt was made to state a hypothesis as regards the mode of inheritance. The results of our investigation of twins have shown that the personal tempo assuredly depends on special inherited dispositions. But it is, of course, not impossible that the manifestation of these inherited dispositions is more or less closely dependent on other psychic or physical characters, which affect the tempo as modifying factors. Perhaps, too, inheritance may occur in such a manner that a certain tempo appears only if simultaneously determined by other hereditarily determined characters. If these are lacking, then another tempo is manifested. On the hypothesis of factors modifying the tempo, or on that of its dependence on other hereditarily determined characters, the special genes of the personal tempo might be a single pair of factors. But if we discard such hypotheses, then in the light of our results we must of course exclude the possibility of an inheritance monomerically determined—that is, depending upon one pair of factors. The different tempi of the children occurring in the case of different parental combinations cannot be wholly explained by the dominance of the quicker factor, nor by that of the slower factor, nor yet by that of the moderate tempo over the slower and quicker tempi.

Nevertheless, in the light of our results we may put forward another hypothesis, namely, the hypothesis of an inheritance dependent upon several homomeric allelomorphic series. In an allelomorphic series the different degrees of a character are quantitatively graded; the high grades are occasionally dominant over the low. If the two homomeric allelomorphic series are inherited independently

of one another, then as a result of the different possible combinations of the values of the paternal and maternal allelomorphic series in the children characters are manifested which differ greatly from those of the parents, not only on the recessive, but also on the dominant side. As regards the inheritance of the personal tempo, this would mean that the children might equally well have a quicker or a slower tempo than both their parents. Our numerical results are completely in harmony with the assumption of two homomeric allelomorphic series with the dominance of the quicker tempo. That parental combinations in which one or both parents are quick may have moderate or slow children is at once comprehensible if the quick tempo is dominant. In those parental combinations in which both parents are slow the values of the allelomorphic series are so small that even from the addition of the different values in the children only a moderate but not a quick tempo results. If on the other hand the tempo of the parents is moderate, the summation of these "moderate values" may result in the appearance of a quick tempo in the children.

But in the light of the results of the second comparison of parents and children yet another hypothesis of the inheritance of the personal tempo is possible, namely, the hypothesis of an intermediate inheritance, so that the manifestation of the personal tempo is not determined by *one* dominant inheritance-factor of an allelomorphic pair or series, but both the factors existing in the inheritance-complex (received from either of the parents) determine the tempo. An intermediate inheritance may also occur in a quantitatively graded allelomorphic series. Assuming that the father has a tempo whose quantitative value is fourteen, which has arisen intermediately from the two values $(20 + 8) : 2$, while the tempo of the mother has a quantitative value of fifteen, arising from $(20 + 10) : 2$, then according to Mendel's Law children may be born with the values: $(20 + 20) : 2 = 20$. $(8 + 20) : 2 = 14$. $(20 + 10) : 2 = 15$. $(8 + 10) : 2 = 9$.

The ratios of the children who are quicker than, similar to, and slower than their parents are as one to two to one: the typical intermediate inheritance. These ideal numerical results were not attained in our findings. For example, in the two concordant parental combinations—concordant and moderately concordant—we find about twenty-two per cent of children who are quicker than their parents, sixty-three per cent who are similar, and fifteen per cent who are

slower, which gives a ratio of 22 : 63 : 15, instead of the ideal ratio of 25 : 50 : 25. These results however do not seem to me to be of such a character as completely and infallibly to exclude an intermediate inheritance. For the time being, however, I should not care to decide which of the two hypothesis is the more probable: inheritance depending on two allelomorphic series with dominance of the quicker tempo over the slower, or on one allelomorphic series with intermediate inheritance.

As for the question of the sexual conditioning of the personal tempo, I will here only briefly emphasize the fact that in the light of the foregoing results an enhanced influence of the one parent (whether the father or the mother) in the production of the personal tempo cannot be demonstrated. The number of children having mothers of the quicker tempi who fall into the quicker groups is, as a matter of fact, somewhat larger, but when these variations are statistically considered we find that it is equal to the number of children of fathers of the quicker tempi who fall into the quicker groups.

The results of our enquiry—of which only a very condensed account has been given here[2]—have shown that it is possible, by the principles and the methods of scientific genetics, not merely to demonstrate the inheritability of psychic characters, but also to form hypotheses as to the mode of their inheritance. Valuable and in many cases even necessary though it may be to compare and combine casuistic material, the incontestable evidence of the inheritance of psychic as of physical characters can be obtained only by the comprehensive and statistical investigation of twins and families. If in the future it is possible to extend and improve the methods of apprehending and investigating the elementary psychic and mental characters, it will at the same time be possible to probe more deeply into the scientific problems of heredity. The investigation of the personal tempo represents a modest step in this direction.

[2] For an exhaustive description of the inquiry and its results see *Das persönliche Tempo. Eine erbbiologische Untersuchung,* which appeared as Vol. 4 of the *Sammlung psychiatrischer und neurologischer Einzeldarstellungen* (George Thieme: Leipzig, 1933).

THE HOMING INSTINCT OF THE PHILOSOPHER

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In bidding godspeed to the good Pantagruel and his companions the high priestess Bacbuc commended them to the protection of "that intellectual sphere whose centre is everywhere, and whose circumference is nowhere, whom we call God." So says the good Alcofribas, a prophet who loved his fellowmen, and bore them messages with the hope that they, becoming wise thereby, would make of this our earth a Utopia.

In so using that notion of an intellectual sphere Rabelais was recognizing that there are two intellects, the one made wholly of protoplasm—the concern of the psychologist: the other metaphysical —the concern of the philosopher? If so, he stands out conspicuous from that crowd of philosophers who jumble the two intellects into one. Any one of them when we ask for information regarding the intellect that is not made of protoplasm dips his hand into his pocket, feels round, draws forth a photograph of himself and hands it to us, as a map of the universe. It is for the psychologist to explain why. This task is not difficult if we recognize that the fundamental property of protoplasm is the proneness of its every particle so to function as will tend to ensure there being for ever and ever some protoplasm somewhere or other on this earth of ours.

From its private point of view a leucocyte in the veins of a man is a creature. To the man that leucocyte is not a creature, but merely one of the cells of that mass of cells which together form the creature, himself. To the arch-creature Protoplasm, man is not a creature but merely a bushel or so of the cells of itself. This arch-creature, Protoplasm, which covers the earth with a thin film of life and comprehends every particle of protoplasm that ever was or is or will be, is a creature well worth the serious study of the psychologist, for it is the key to everything in his province. It is of little importance to

the metaphysician, for to his concern, the Order of Things, protoplasm is, or ought to be, of negligible importance.

What are the psychological properties that every healthy protoplasmic cell must have? A cell is a short-lived common soldier engaged in the long stern fight of Protoplasm to live for ever, it has no practical chance of surviving long enough, itself, to be in at the finish. Or, a cell may be likened to the runner in a relay-race, who goes his allotted distance and then is seen no more. So, the unselfishness of the forlorn-hope, the unselfishness of the first-lap runner in a relay race, is a basic psychological property of every fragment of healthy protoplasm. With that unselfishness there must be a selfishness of another kind; the cell must take itself very seriously and act in the faith that on its doing its share well depends the success of Protoplasm in the fight against Time. To that particular form of selfishness (the impulse to help something other than the creature's own individual self) a novelist, honoured in his later days, gave the name Egoism. It is not to be confused with Egotism (the longing for physical comfort) nor with Egocentricity (which is a morbid phenomenon, and not a fundamental or a necessary property of healthy protoplasm).

Protoplasm has other fundamental psychological properties, but they need not be mentoned here, as egoism is enough to explain the homing instinct of the philosopher. Owing to the egoism of his protoplasm the philosopher (like the rest of us) strives to do some good to something that is not his individual self. He works to promote the welfare of civilization. His success is enormous: it is hardly to overstate the fact to say "No metaphysicians no civilizations." But, here's the trouble. Protoplasm is quite unconvinced that human civilizations are useful to its continued existence. For that matter, it has not yet decided whether to allow a part of itself permanently to take the form of a human race. "A little lower than the microbes" may for anything we know to the contrary be Protoplasm's view of us. (It is a good and pleasant thing to dream of our earth covered some day with a wealth of pain-free, carefree Life). Protoplasm highly commends the agriculturist who makes a bushel of protoplasm to be where only half a bushel was before and his wife who gives birth to a dozen babies: they are contented, to them is peace of mind, their virtue is its own reward, they need no medals, no honours, no recognition, no mention in a dictionary of

national biography, no burial in an abbey. For being dead, they are still alive through their progeny of cabbages and children. But the poet and the painter and the actor and many others are less fortunate. Protoplasm with its old fashioned (how many million years?) ways hasn't yet taken it in that these folks are moral (i.e. tending to prolong the life of Protoplasm). So their labour is not its own reward, it leaves them self-conscious and they are driven to suppose their particular Art "the one far-off divine event toward which the whole creation moves." Which, as Euclid said of some of his own suppositions, is absurd.

The lot of the philosopher is specially unfortunate: Protoplasm abhors intellect. "Of the tree of the knowledge thou shalt not eat of it: for in the day that thou eatest thereof thou shalt surely die." And kill others too: the site of a university is a solution in the continuity of Protoplasm: bricks and mortar where there had been grass. "Men sholde nat knowe of goddes privetee." As it is the absent-minded that keep the race going, philosophizing is not wont to be its own reward. Therefore the philosopher becomes self-conscious and is impelled by his passions to magnify the importance of the thing that most distinguishes him from his fellow creatures. That thing is protoplasmic intellect. Therefore, wherever it may begin, a philosophical system will ever tend towards the conclusion that the universe exists in order that there may be intellect. Euclid might again be quoted.

NEWS AND NOTES

U. S. A.

Behaviorism on the Wane

Whether it is the depression, or only the fickleness of Americans, or perhaps the awakening of the too sanguine that is responsible, the last few months have brought to a head many critiques of both behaviorism and psychoanalysis. Behaviorism is gradually declining as a systematic point of view, although its terminology is still in vogue in many laboratories where, as one European visitor has described it, the investigations are all on sensations and reflexes and reflexes and sensations.

Behaviorism as a psychological system is falling more by the wayside as its promises and pledges have failed to materialize.

In view of these facts it is strange that L. L. Bernard in *Sociologus* (vol. VIII) should report that social psychology in America is mainly behavioristic. As a matter of fact, the most widely used textbook in this field, F. W. Allport's *Social Psychology,* I understand on good authority, has within the last two or three years, been criticized by teachers because of the behavioristic terminology and factitious interpretations of phenomena which cannot be explained by stimuli and response relationships or prepotent reflexes. Much of course depends upon what we call behavioristic, but, allowing for the natural amount of influence which the environmentalist view has brought into the field, the tide is turning distinctly against the typical behaviorism.

Satisfyingness as Chief Factor in Learning Proved?

The publication of Thorndike's experimental proof of the law of effect in learning (in *Science,* February 10, 1933), stating that a "satisfying after-effect strengthens directly the connection producing it," has elicited a rejoinder from one of his critics, R. M. Ogden of Cornell, in the same journal. Ogden points out that Thorndike's proof is valid only under the assumption that a course of behavior consists of a number of separate and discrete acts, whereas in reality, learning is "a self-regulating process, the parts of which are not discrete acts but members of the whole unit of action."

The issue is of course between a hedonistic associationism and *Gestalt* psychology.

In a later issue, E. G. Boring, of Harvard, comes to the aid of Ogden, arguing seemingly from an epistemological point of view, stressing the temporal sequence involved in the principle of causality.

Anti-Vivisection Bills

In a number of states (so far, New York, Massachusetts, and Maine) bills have been introduced this year to restrict the experimental work on animals. The Anti-Vivisection Society and other organizations have been very active of late in bringing pressure to bear upon legislators; and the American Psychological Association, with the aid of affiliated societies, is combatting such proposed measures.

Sign of the Times

In the *Psychological Exchange* we read the following item, by a woman associate professor of Philosophy and Psychology:

> We have a great deal of new equipment—some never unpacked and set up—no part of which is be-

ing used. I will trade any or all of it for (a) bound periodicals for the library, (b) filing cases, or (c) pictures of psychologists—Wundt, etc.

A. A. R.

Mental Hygiene

The following officers were re-elected at the annual meeting of the Board of Directors of the National Committee for Mental Hygiene: Dr. William H. Welch, honorary president; Dr. Chas. P. Emerson, president; President James R. Angell of Yale, Dr. W. L. Russell, professor at Cornell, and Dr. Bernard Sachs, vice-presidents; Dr. C. M. Hincks, general director; F. W. Allen, treasurer; and C. W. Beers, secretary.

New Books

Among the new books in psychology are *The Correction of Defective Speech* by E. B. Twitmeyer; Moss and Hunt's *Foundations of Abnormal Psychology;* Shepard I. Franz and Kate Gordon's *Psychology,* a new textbook; F. Berger Karpf's *American Social Psychology;* W. B. Pillsbury's *An Elementary Psychology of the Abnormal;* E. D. Martin's *Civilising Ourselves;* Morris S. Viteles' large tome *Industrial Psychology;* and A. A. Roback's *Self-Consciousness and Its Treatment.*

Measuring the Gene

At the meeting of the American Association for the Advancement of Science, in Atlantic City, an ingenious method was described by which the *gene,* containing the biological character of the individual, could be measured.

New Psychology Periodical

We quote from *Editor and Publisher* the following item with reference to a new magazine which aims to popularize psychology without vulgarizing it.

"The Modern Psychologist is the title of a new monthly publication which made its first appearance recently, under the editorship of Dr. Dagobert D. Runes. Among the contributors and editors are Sigmund Freud, Alfred Adler, A. A. Roback, Joseph Jastrow, Carl G. Jung, Havelock Ellis, Bertrand Russell. The object of the magazine is to inform the 'intelligent layman' of the present status of the various phases of psychoanalysis and psychiatry."

So far seven issues in quarto have appeared.

Psychology of the Blind

A two volume work on the psychology of the blind is about to be published by T. D. Cutsforth who has just completed an elaborate piece of research on the blind. The material will cover not only the functional phases but also such topics as the personality of the blind.

Science and Value

At the Atlantic City meeting of the American Association for the Advancement of Science, E. Horn, retiring vice-president of Section Q (Education), gave an address on "Science and the Problem of Value."

Meetings and Organizations

The number of meetings held by psychological and affiliated organizations in the United States averages about one every fortnight. There are academy meetings, clinical and personnel, as well as educational gatherings, association meetings, and local conferences. The number of papers read on psychological subjects in a year approaches the seven hundred mark.

Germany

German Politics

Among those German professors who had to resign from their chairs are *William Stern* of Hamburg University, the "Gestaltist" *Max Wer-*

theimer of Frankfort University, Co-Editor of Psychologische Forschung, *G. Husserl,* the son of the philosopher E. Husserl of phenomenology's fame, and *Eduard Spranger* who publicly stated his reasons for resigning his chair at The Berlin University. "I am filled with the greatest anxiety as to the force of the leadership principle, when neither the Rector nor the Minister has succeeded in removing a manifesto which contains passages bound to give the deepest offence even to the most Nationalist of readers. (The manifest of the student organizations throughout Germany put it down that no Jew should be allowed to write German but should write in Hebrew and that German books written by Jews should be marked as translations from Hebrew). Taken together with the news from other Prussian universities, these circumstances make me feel that I should no longer find access to the new generation."

Astrology refuted.

The *Zeitschrift fuer induktive Abstammungs- und Vererbungslehre* contains an article by O. v. Verschuer on the biological foundations of the study of twins, triplets, etc., in human beings. The article is written very carefully and thoroughly and deals with a test undertaken by the author at the request of the president of the Astrological Society of Germany. Four different methods were employed. The various astrologers were supplied with the place, day, hour, and minute of birth according to official records, and with the social surroundings of the twins in question, and then were asked to furnish a horoscope. The various pairs of twins had been selected according to important events in their lives, e.g., marriage, severe illness, nervous diseases, idiocy, or death of one or both partners. In the reports supplied to the author by the astrologers not one of these events was given correctly and most of the interpretations were incorrect. According to the statement of one of the astrologers one of the partners of a pair of twins had died three years ago when in fact both were alive.

Spiritualism.

The widow of Dr. Schrenck-Notzing has published *Die Phaenomene des Mediums Rudi Schneider* (de Gruyter, Berlin) making use of Schrenck-Notzing's posthumous papers. There is an introduction by Eugen Bleuler. Most of the papers had been made ready for printing by the deceased before his death. The work contains attempted explanations of the phenomena by Driesch, Gruber, and G. R. Heyer, and others as well as the well-known vigorous replies by Schrenck, e.g., one addressed to Dr. Wolff of Basle, in which he explains at length his views on a séance with Rudi Schneider which took place on May 29, 1928. "Driesch admits that there could be no better system of checking, as there are three distinct checks. . . . I can't be expected each time a new professor arrives to give him details of all the possibilities of checking. . . . A stage is reached where sense becomes nonsense. . . . Physically and from the point of view of any possible deception, there is no valid objection to the reality of the phenomena. . . . Unfortunately professors come to this kind of séance as though it were a theatre. . . . This being the case it is high time that some student of repute and official standing should sacrifice himself and undertake to attend all the séances for a period of two or three months." In spite of its controversial nature the book is of great value on all questions of modern experimental occultism inasmuch as it is a personal confession of Schrenck and a compendium of his experiences.

Dr. Krüger (Tilsit) contributes an article on the fitness of children to give evidence in criminal procedure

in No. 2 of Vol. V of the *Vierteljahresschrift fuer angewandte Kriminalistik*. The author contends that the credibility of children must be judged separately in each individual case and that any definitive judgment would be out of place.

. The *Zentralblatt fuer Psychotherapie und ihre Grenzgebiete* (Vol. V, No. 12) contains an article by Anneliese Mandowsky on comparative psychological investigations on handwriting, more particularly with regard to schizophreny and manic-depressive dementia. On a comparative basis the authoress reaches the conclusion that the handwritings of patients suffering from schizophreny and depressive dementia display analogous disturbances while those of manic patients tend to show some similarity with the normal. The handwriting does not suffice to determine whether the writer is insane or not, but the handwriting furnishes indications as to the type of character or disease of the writer. Thus if we know that the writer is insane, the handwriting may be a useful instrument allowing us to diagnose the kind of disease; in the case of schizophreny it is possible even to determine the stage it has reached.

BOOK REVIEWS

JOCASTA'S CRIME. By Lord Raglan. Methuen & Co. Pp. 215. 7/-.

The book deals with various, if not aspects of the incest taboo, and refutes the theories which have attempted to explain its origins.

The author's main conclusions are that in-breeding is neither harmful to animal nor to man, the horror of incest neither instinctive nor natural, and that the particular belief that incest is a deadly sin, as, in fact, any religious belief, does not arise from rational measures, since early man never was a legislator or a social reformer, but rather without questioning regarded the habits of his tribe as divine law.

Lord Raglan thinks that the main errors of other workers are mainly due to their bad habit of explaining the taboos of earlier mankind in terms of their own psychology, and remarks that some writers "share with the lowest savages the belief that the incidental and temporary features of their own culture are inevitable, eternal, and universal."

He rather makes fun of Freud, who explains the incest taboo with the feeling of sin of the murdered and devoured father, though there is not the slightest evidence to support this theory. "A nerve specialist is no more entitled to assume that neuroses which he finds among his patients were found among early mankind, than is the chiropodist to assume that early man was a martyr to corns."

Lord Raglan's own explanation reads, however, far less convincingly than his witty criticism of other workers' theories. He arrives at some sort of combination of various beliefs which, though apparently fitting the known facts, or at least those summarized by himself, does not sound very plausible either. It amounts to some sort of a combination mainly of two contradictory beliefs, that it is dangerous to have intercourse with a woman who lives on the same side of running water, and that in order to ensure his survival after death a man must marry his sister.

R. S.

INDIVIDUAL PSYCHOLOGY PUBLICATIONS. Medical Pamphlets 1-7. C. W. Daniel & Co., London. 2/6d. each.

Alfred Adler's visit to London (January, 1931) gave rise to the issue of a series of booklets on individual psychology, in which seven small volumes have appeared up to January 1933. Each booklet contains a number of lectures, discussions or smaller treatises of notable individual psychologists. The collection is introduced by a volume containing Adler's diagnosis of the life-style; this was followed at regular intervals by discussions on Anorexia nervosa, on various sexual disturbances, on the scientific principles of individual psychology, on psychosomatic disturbances, on the position of individual psychology with regard to social problems and education, and to its task in practice.

The editor is Dr. F. G. Crookshank, London (for the Medical Society of Individual Psychology) and the collaborators are W. L. Brown, O. H. Woodcock, J. C. Young, S. V. Pearson, M. B. Ray, M. Robb, E. Wexberg, H. C. Squires, and many others in America, Germany, and Austria.

THE INTERPRETATION OF DREAMS. By S. Freud. London, G. Allen & Unwin. Pp. 600. 18/.

This is the third English edition, corresponding to the eighth German edition. The original version has been revised by the author to conform more closely to more recent material and the new psychoanalytic terminology.

GENIUS AND CREATIVE INTELLIGENCE. By Nathaniel D. M. Hirsch. Cambridge, Massachusetts: Sci-Art Publishers, 1931. Pp. 339. $3.00.

To workers in those fields of human endeavor that touch upon the origins, adaptations, or self-expression of the Altruist and the Genius, Dr. Hirsch's work will be stimulating and enlightening.

Indeed, so straight and deeply to the heart of creative intelligence and the intuitional processes does he go—returning laden with fresh material which is made all the more impressive by the inspired manner of its presentation—that the book constitutes a very obvious talisman of the genius of its author.

The study is divided into three major parts. Part I (History, Creative Adaptation, and Genius) deals with the socio-historical development of Man, his adjustments, and some future possibilities. Part II (The Psychological Constitution of Man) discusses the nature, evolutions, relations of instinct, intelligence, impulse to socialization, language, emotions, and creative intelligence. Part III (An Inquiry Concerning the Nature of Genius) analyzes the genius as a personality.

A wealth of good grist is strewn throughout the book, and the author's rare order of thought and his ability to grasp and imprison highly tenuous and elusive phenomena in words, is especially revealed in passages describing the psycho-biological maturations occurring within the sheath of the germ plasm and in the environmental conditioning of the genius personality.

Among biological sources of genius production, Dr. Hirsch gives prominent credit to intermarriage of superior individuals of different natio-racial groups, in which diverse mixtures enrich mutations. The mutational principle is thus raised from the sperm to the brain, from the racial to the individual, from the status of an instinctive species-impulse to the position of an intellectual-intuition urging a self-conscious individual.

Dr. Hirsch is to be congratulated on a sincere and fine piece of work, and one that may with profit be utilized by psychologist, philosopher or artist.

ERNEST SEEMAN.

STUDIES IN EXPRESSIVE MOVEMENT. By Gordon W. Allport and Philip E. Vernon. With a chapter on matching sketches of personality with script by Edwin Powers. New York: Macmillan and Company, 1933. Pp. xii, 269.

In an environment where personality testing has been confined to the measurement of specific reactions in the most mechanical manner, it is fortunate that Allport and Vernon have undertaken a study to throw light on the problem of consistency in expression. The authors regard their investigation "merely a critical propaedeutic to the elusive problems of psychodiagnosis," but perhaps this is too modest a claim, for the material and the results throw light on the general nature of personality as well.

The book consists of two parts:

A. The Consistency of Gesture and Style

B. Handwriting and Personality

The first chapter covers the literature on the subject beginning with Lavater's physiognomical observations and ending with the recent studies in America and Germany. The examination is to a certain extent classificatory and above all crit-

ical. Not the least valuable part of the chapter is the comprehensive schedule of expressive movements, which provides a reservoir of problems for the future investigator to consider.

In chapter II we find the methodological considerations, the discussions of statistical reliability, including formulae and corrections. Then follow chapters on the technique, the experiments proper, the correspondence of measures, and a general discussion of personal variability and consistency.

Twenty-five subjects participated in the experiments which comprised a number of different tasks: estimation of distance and angles, arranging cubes, tapping, stylus compression, drawing squares, writing under various conditions, etc. Ratings were also made by both the experimenters and the subject. The rigidity of control with which the experiments were carried out was a guarantee against objections. The investigation dealt with "individual differences in the manner of performing adaptive acts, considered as dependent less upon external and temporary conditions than upon enduring qualities of personality."

The results all pointed in one direction, viz., that the expressive behavior of the subjects revealed an inner consistency, a harmony or integration of the personality. The consistency-ratio, to be sure, was not to approach unity, but the correlation was significant enough, with more than a suggestion that there are group-factors present in the various activities. Three such group factors have been detected, viz.,

(a) an area or expansive factor, (b) a centrifugal factor, and (c) a factor of emphasis in movement.

It is in the interpretation of the results that the authors, presumably Allport in particular, take up the cudgels for a view which is not popular in American laboratories, viz., the doctrine that our expressive behaviour is conditioned by the structure of our personality as against the various theories of discrete acts such as the notion of identical elements or that of unique traits or the specificity theory as expounded by Hartshorne and May. The criticism of these theories is pointed and, it seems to the reviewer, unanswerable.

Allport and Vernon themselves are inclined toward an empirical personalism which holds that there is a unity in personality, reflected to a large extent in expression, thus explaining why expressive acts and habits disclose a certain consistency among themselves. The physiological speculations of Dodge, Hsiao, and Köhler are introduced to account for the results from a dynamic angle.

The second part of the book is an extensive treatment of graphology *pro* and *con*. The review of the literature on the subject is perhaps a little too inclusive in that it includes references to at least one graphologist who can lay no claim to even semi-scientific dignity. The most important item in this survey is the puncturing of the Hull and Montgomery experiment which was instrumental in further alienating the altogether too conservative American psychologists from the rightful claims of graphology. This investigation, cited by adverse critics of graphology as a sort of gospel truth, has had a number of congeners cropping up of late. We may cite, e.g., a study "On the Determination of the Intelligence of Adults from Samples of their Penmanship," by B. H. Broom and M. Basinger (*Journal of Applied Psychology*, XVI [1932], No. 5, pp. 515-518) in which it is brought out that twenty-five adult judges who were asked to rate thirty students for their intelligence and weight on the basis of samples of their handwriting failed to place them correctly and that "it is as easy to judge weight from penmanship as it is to judge in-

telligence; neither is judged correctly except by chance." It has not occurred to the investigators that there is a difference between a casual judge and a competent judge, that medicine might be condemned as a pseudo-science because a number of school teachers, asked to correlate certain symptoms with a certain pathological condition of the organism could not diagnose the cases with any degree of reliability.

It was on the basis of such experiments that the reviewer's favorable opinion of graphology in the little book *Personality, the Crux of Social Intercourse* was frowned upon by certain psychologists, who did not stop to think that the opinion was based on empirical evidence far more conclusive than the results of such worthless investigations.

The alignment of G. W. Allport and his assistants with the open-minded few who dare to espouse a cause which has not yet gained *entrée* in the psychological counting houses is a favorable omen and tends to strengthen the position of graphology in American universities. Not that Professor Allport has shut his eyes to the limitations of graphology, but he has at least taken the pains to test it and not a mere shadow of it. The only sound procedure in testing graphology is to employ graphologists and not "judges" who admittedly know nothing about the subject. The correlations obtained in the experiments and the validity of Dr. Saudek's judgments in particular are a tribute to graphology and a confirmation of the reviewer's experiences.

The two-hundred odd bibliographical references, the indexes, and an appendix showing the intercorrelation of variables round out a fine piece of research which has been not only carefully planned and executed but methodologically interpreted.

There is little to say in criticism of Allport and Vernon's book. In the matter of controls it might have been desirable to obtain certain additional bodily measurements, for although the authors did correct the length of stride for height of subject they did not make allowance for other factors as weight or length of arm in influencing other motor performances. Through such bodily measurements we might have had a further clue to the expressive factors.

In the recounting of Saudek's graphological results, the authors have omitted to refer to the rather important finding that in our writing we are influenced by visual forms of other handwritings (a sort of grapnic fixation).

As to the need of a term to express the type of movements which the authors investigated, I should suggest the term ***kinidiom*** to fill that want. A ***kinidiom*** may be defined as a form of movement, either simple or complex, expressive of an individual and distinguishing him in that respect from other individuals. The segment of the personality field which would systematically cover such studies might be designated as ***kinidiomatics***.

A. A. ROBACK.

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E. A. SEEMAN, *Business Manager.*

Sworn to and subscribed before me this 10th day of May, 1933.

C. B. MARKHAM,
Notary Public.

My commission expires August 7, 1933.